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# HANDBOOK

FOR THE

12-PR. B.L. GUN (MARK I).



(LAND SERVICE.)



LONDON:

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,  
BY HARRISON AND SONS, ST. MARTIN'S LANE,  
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N.B. -This book is corrected up to March, 1891. Any alterations which may be suggested, should be forwarded direct to D. of A. Department, Woolwich.

# CORRIGENDA

FOR

## Handbook for the 12-pr. B.L. Gun (Mark I), 1891.

LAND SERVICE.

- 
- (1) On page 15, line 38, after "forward end of the piston rod" insert  
"Axletree.—The cup in the top carriage for lubricating the sleeve on the axletree must be filled with oil once a fortnight; this cup is fitted with a lid in which are two small holes for filling. These holes are closed by a spring cover, and must be always kept closed except when filling."
- (2) On page 15, at the end of last section but one, for "replacing pin," read  
"replacing the pins"
- (3) On page 15 strike out the last section, from "Replace the joint . . . . ." to " . . . . before firing," and substitute  
"The brake, on firing, should do no more than just skid the wheels. To adjust to this, the brake is put hard on by hand, and the connecting rod screwed up until there is a distance of  $4\frac{1}{4}$  inches between the back of the cascade pin and the bottom of the hexagon on the rod."
- (4) On page 37, last line but one, " . . . . he finishes the laying," insert asterisk at "laying," and add footnote—  
\* "Being careful to end up with depression, and 'trail right' with the traversing gear in Mark II carriage."
- (5) On page 38, in the detail "To make ready and fire," after the words "It should be removed and examined as ordered," add new paragraph—  
"When firing blank ammunition No. 1 will assure himself, before the gun is reloaded, that no unconsumed portions of the silk cloth of the previous round remain in or near the chamber."
- (6) Strike out pp. 44, 45, and the first two paragraphs on page 46, referring to "Hasty Disablement of Field Guns."

[Vide A.O. 133, June, 1891.]

(Wt. 17299 1500 12 | 91—H & S 6749)



- (7) On page 49, "Keys, split, of sizes . . . . , " for 9 read 18.
- (8) And in column "Where carried," for "Under case shot in<sup>(2)</sup> near gun-limber box," read  
 "Under case shot in near gun-limber box<sup>(2)</sup>."
- (9) On page 53
- |       |   |                           |                 |
|-------|---|---------------------------|-----------------|
| Fuzes | { | percussion small          | for 24 read 12. |
|       |   | time and percussion short | " 48 " 59.      |
|       |   | " " " middle              | " 14 " 9.       |
- (10) and opposite "time and percussion middle. No. 54," in the column "Where carried," for "1 in each limber box, under shrapnel shell," read  
 "5 in the near, 4 in the off, limber box, under shrapnel shell."
- (11) On pages 55, 57, 59 (footnotes) for  
 "† For Mark I carriage only  
 "† For Mark II carriage only," read  
 "† For Mark I equipment only.  
 "† For Mark II equipment only."
- (12) On page 56, opposite "Felloes, No. 42 wheel, { ordinary † .. 2  
 slip † .. 2  
 in column "Where carried," for "store wagon limber" read  
 "store wagon body."
- (13) On page 56, against "Hooks, dragshoe, B.L. 12 pr.," strike out †.
- (14) On page 57, opposite "keys, split, guard-iron, B.L. 12-pr.†" in column "where carried," for "store wagon limber," read  
 "store wagon body."
- (15) On page 57, correct "keys, split round, loop," &c., to read
- |      |   |       |        |  |   |
|------|---|-------|--------|--|---|
|      |   |       |        | War,<br>3 months' supply.              | For use in<br>Peace, 12 months' supply. |
| keys | { | split | } loop | $\cdot 187 \times 2 \cdot 625 \dagger$ | .. 48                                   |
|      |   |       |        | $\cdot 25 \times 2 \cdot 5 \dagger$    | .. 36                                   |
|      |   | round |        | $\cdot 312 \times 3 \cdot 5 \dagger$   | .. 24                                   |
|      |   |       |        |  | 24<br>18<br>12                          |
- (16) On page 57, opposite "leathers, block, brake, B.L. 12-pr.†" insert in column "For use in Peace, 12 months' supply"—"12."
- (17) On page 58, opposite "packings, hydraulic buffer, B.L. 12-pr.†" insert in column "for use in Peace, 12 months' supply"—"3."
- (18) On page 58, opposite "plugs, filling hydraulic buffer,†" in column "where carried," read  
 "forge limber."

- (19) On page 58, for "rivets, iron, bosshead,  $\frac{1}{4}$ -in.  $\times$   $\frac{3}{4}$ -in.†" read  
 "rivets, iron, bosshead,  $\frac{1}{4}$ -in.  $\times$   $\frac{3}{4}$ -in.†"
- (20) On page 59, the bracket "springs, B.L. 12-pr." should be amended  
 to read

		War, 3 months' supply.	For use in Peace, 12 months' supply.
Springs, B.L. 12-pr.	{ disc, steel, for spindle, pinion		
	elevating† .. ..	12	6
	seat* set of 6 .. ..	1	—
	draught, limber† .. ..	4	2
	volute, hydraulic buffer† ..	6	2
	pawl, brake† .. ..	1	1
	spiral { connecting† .. ..	6	2
	{ releasing† .. ..	1	1
	stay, tensile† .. ..	2	—
	{ spiral, gland, hydraulic buffer†	2	2

The bracket in column "Where carried" should be extended to include "springs disc, steel for spindle pinion, elevating" in the store wagon body.

- (21) On page 59, opposite "spokes, No. 38 wheel" insert—"1."  
 " " " 42 { back† " "1."  
                   { front† " "1."  
 in column "For use in Peace, 12 months' supply."  
 and in column "Where carried" opposite "spokes, No. 42  
 wheel, back and front," for "store wagon limber" read  
 "store wagon body."  
 and opposite "spoke, No. 37 wheel," for "forge limber" read  
 "store wagon body."

- (22) Diagram A.

In off wagon limber box, left compartment, for "3 T. and P. mid.  
 fuzes, under" read

"3 T. and P. short fuzes, under."

In near wagon limber box, right compartment, for "3 T. and P. mid.  
 fuzes, under" read

"1 T. and P. mid. } fuzes, under."  
 "2 T. and P. short }

In off wagon body box, rear compartment B, dele

"B" and substitute "A."

In near wagon body box, rear compartment B, dele

"B" and substitute "A."

(23) *Diagram B.*

The four corrections above given for *Diagram A*, are also to be made in *Diagram B*.

In near limber box, right rear compartment, *for*

“ 2 case shot,  
9 split keys, under ” } *read* { “ 2 case shot,  
18 split keys, under.”

List of stores on gun carriage and limber: in stores carried “ on lid  
of near box,” *dele*

“ 1 bolt brake band.”

(24) *Diagram D.*

In “ compartment ‘ G ’ wagon body,” *for* “ springs brake ” *read*

“ springs, spiral, gland.”

And below “ springs, spiral, gland ” *insert*

“ springs, spiral, connecting.”

(25) *Diagram E.*

In wagon box III, *for* “ springs brake ” *read*

“ springs, spiral gland.”

And below “ springs volute ” *insert*

“ springs, spiral, connecting.”

(26) *Diagram G.*

In list of stores carried in “ short tray,” *after* “ Pin, shaft,” *insert*

“ Plug, filling, hydraulic buffer.”

(27) *Diagram H.*

In list of stores carried in “ short tray,” *after* “ pin, shaft,” *insert*

“ Plug, filling, hydraulic buffer.”

(28) *Diagram C* should be cut out altogether.

(29) *Diagram F* should be cut out altogether.

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## 12-pr. B.L. Gun (Mark I.)

### DESCRIPTION OF GUN.

#### GUN.

#### Plate I.

#### *List of Changes, § 4877.*

Material	..	..	..	..	..	Steel.
Length, total	..	..	..	..	..	92.35 inches.
Weight, average	..	..	..	..	..	7 cwt.
Preponderance*	..	..	..	..	..	10 lb.
Bore	..	{	diameter	..	..	3 inches.
			length { in inches	..	..	84 "
			length { in calibres	..	..	28 calibres.
			capacity, including chamber and grooves	..	..	647 cubic inches.
Chamber	{	diameter	..	..	..	3.625 inches.
		length	..	..	..	11 inches.
		capacity	..	..	..	118 cubic inches.
		system	..	..	..	Polygroove—hook section.
Rifling	..	{	twist	..	..	Increasing from 1 turn in 120 calibres at breech to 1 turn in 28 calibres at 35.8 inches from breech, remainder uniform 1 in 28 calibres.
			length	..	..	71.6 inches.
			grooves {	number	..	12.
				depth	..	0.04 inch
Means of rotation	..	{	width	..	..	0.6 "
Vent	..	..	..	..	..	Copper driving band.
						Radial, removable, 1 inch in front of obturator.

All 12-pr. B.L. guns will in future manufacture be rifled on the principle of six grooves to each inch of calibre. The depth of the grooves remaining the same as at present.

\* Six guns, viz., No. 10 to No. 15, have a preponderance of 42 lb.  
(5973)

## THE GUN.

The gun is made entirely of steel, and consists of a tube, over which is shrunk a jacket with trunnions, secured longitudinally by interlocking, and prolonged at the breech for the reception of the screw. In front of the jacket is shrunk the C hoop, and to the breech-end is screwed a hood which gives protection to the breech fittings and carries the elevating bolt and sockets for the tangent sights.

The chamber is cylindrical, slightly coned at the entrance, and terminating in front with a curved slope.

## Breech-closing Arrangements.

### Plate II.

The breech is closed by a screw provided with a cam lever, and has three portions of the screw thread removed longitudinally, each one-sixth of the circumference. The interior of the gun at the breech being prepared in a similar manner, admits of the screw, when the raised portions are placed opposite the smooth surfaces in the gun, being pushed home, and locked by the sixth of a turn.

The screw has hinged to it a cam lever, by which it is locked and unlocked, the cam portion of this lever (when the breech screw is locked) falls into a recess in the carrier ring, and so prevents any movements of the breech screw during firing. In depressing the cam lever, after the breech screw is unlocked, the cam acting upon the surface of the carrier ring, partially withdraws the breech screw, together with the obturator.

Passing through the breech screw is a solid spindle, having at its inner end a mushroom head, behind which are placed the obturating pad and discs, and at the outer end a removable spring clip that secures it in the breech screw.

Encircling the rear end of the breech screw, and hinged to the "hood," is a carrier ring, which supports the screw when withdrawn.

The carrier ring is held to the gun during the withdrawal of the breech screw by a "clip," pivoted within the left side of the ring, engaging with a recess in the hood.

A stop bolt in the right side of the carrier ring prevents the breech screw being disengaged from the carrier when withdrawn; at the same time the clip is disengaged from the recess in the hood by means of a spring, which forces its opposite end into a recess in the breech screw, thus securing the latter in the carrier ring. When in this position the whole can be swung clear of the breech opening to admit of loading.

On the left side of the breech is a small hole, in which a pricker can be inserted, to push back the retaining clip of the carrier ring, if necessary.

## Venting.

The gun is furnished with a steel removable vent bolt. The vent channel is 0.15 of an inch in diameter at its lower end for a length of 0.415 of an inch, the remainder being 0.22 of an inch. The vent bolt

is secured by a nut with a spring washer, and the head is fitted with a copper washer to prevent the gas passing between the vent bolt and the gun.

A wrench is supplied for tightening the nut of the bolt.

A special form of pricker is supplied for use with this vent.

## Sights.

### Plate III.



The gun is provided with two rows of sights.

The tangent sights are of steel; the crossheads are furnished with screw deflection leaves, giving deflection to  $1\frac{1}{2}$  degrees right and left, and have notches at the top for rough laying, and small eye holes underneath for fine sighting. The bars are triangular in section, and are graduated on their rear faces to 5,500 yards, for a muzzle velocity of 1,710 ft. secs., and on their right faces to 13 degrees. The sights fit into gun-metal sockets held by fixing screws, and are provided with movable clamps, combined with nuts for fine readings of elevation.

Spring bolts passing through the sockets enter recesses in the sight bars when at zero, and prevent their being shaken out when the gun is passing over rough ground. The bolt on the right side is moved by pushing in, and that on the left by pulling out, so as to make the sights interchangeable.

The fore sights are of bronze, with circular apertures containing diagonal cross wires for fine sighting, and surmounted by steel acorn points for rough sighting. The sights are interchangeable and slide into grooves in front of the trunnions, being retained by spring studs, which are released by raising the catches provided for the purpose.

### (Scott's) Telescopic Sight.

The guns have been fitted with a steel bracket for carrying the telescopic sight. The bracket is firmly attached to the face of the right trunnion by a dovetail and two fixing screws. A bronze adjusting screw is provided in the upper part of the bracket to alter the position of the telescope, so as to correct for difference of level of the wheels. Description and instructions for using, &c., are published in a separate handbook.

## INSTRUCTIONS FOR THE CARE OF 12-PR. B.L. GUN.

The breech fittings should be kept clean and oiled or greased, and in good working order; all working surfaces must be well lubricated, the fittings being taken off sometimes for this purpose, especially after firing.

To lubricate the hinge bolt of the carrier ring without removing the fittings, the small screw on the top of the bolt should be removed and oil poured into the channel, taking care to replace the screw after oiling.

All the fittings of the gun should be treated with care; violence and jerks should be avoided, and no unnecessary force should be employed.

The gun should be examined after firing 150 rounds.

### De Bange Obturator.

This obturator consists of a mushroom-headed spindle of steel, fixed to the breech block by an axial stem, with a pad and a pair of metal discs. The face of the breech screw is flat, and between its smooth surface and the back of the axial head, the pad and discs are arranged. The pad is made of asbestos, worked up with mutton suet to a proper consistency, and enclosed in a strong canvas cover; it is reduced to shape and pressed in a hydraulic machine and afterwards subjected to higher pressure in the gun by firing heavy charges at proof. This pad is enclosed between two tin plates, the outer angles of which are protected by rings of steel. The gun is slightly coned at the seat of the obturator when pushed home, and the pad is provided with a similar taper to ensure a good fit.

#### Action.

When the breech-block is pushed into the gun the obturator enters the chamber with perfect ease; on turning the breech-screw the pad is pressed home into the coned seat in the gun by the travel of the screw. The bore is thus perfectly closed by a species of buffer in contact all round the circumference, while the axial head forms a loose end to receive the force of the gas on discharge. On firing the gun the pressure acts on the steel mushroom head, which squeezes the pad against the breech block, causing it to expand laterally; from symmetry of form and position this expansion must be radial to the axis and equal in every direction, and is sufficient to prevent the escape of the gas. On the pressure being removed, elasticity comes into play and the obturator can be withdrawn from the cone by a straight pull, which can be given as soon as the screw is unlocked.

The pads are almost indestructible, except perhaps from the wear of opening and closing the breech, but if the firing is rapid they may get softened by heat; in this case the pad should be changed and thrown into cold water for a time, when it will soon be restored to good condition again. Spare pads are provided and also steel discs, which should be inserted in rear of the obturator if the pad becomes compressed by firing, but the obturator should always turn freely in the breech screw.

If the pad is not in good order, or there are too many adjusting discs behind the pad, stiffness in working the breech will probably result.

The obturating pad should be rubbed occasionally with Russian tallow, mixed with oil or some other suitable lubricant, and the pad and protecting discs should be carefully handled to prevent them being indented or bruised.

The obturating pad and discs required for use should be kept complete on the steel head in the gun, and the spare in the brass boxes provided for the purpose, as there is a tendency of the pad to swell in the direction of its axis which might cause difficulty in adjusting it on the mushroom.

When the obturator is attached to the breech screw, the removal of the latter from the carrier ring should be done by two persons, as care is necessary to keep the "clip carrier ring" pressed up clear of the breech screw before drawing the latter back, to avoid damaging the obturator. The obturator should, however, always be detached, when possible, from the breech screw before removing the latter from the carrier ring.

### Clip, Carrier Ring.

If, when opening the breech, the carrier ring remains fast, owing to the "clip" not working properly, the latter can be pushed back by inserting a vent pricker in the hole provided for this purpose on the side of the breech.

On the line of march the breech should be kept covered up if possible, to prevent dust and grit getting into the interstices of the breech fittings, which might impede their easy working. A leather cap, which also covers the vent, is provided for this purpose.

The breech fittings should work efficiently, and be free from cracks and burrs. The latter can be removed by filing, but this must be done carefully, so as not to permanently damage the fitting. Should a crack be observed in a breech fitting, it should be exchanged if possible.

Sponges are provided for occasional use in cleaning out the breech opening and removing fouling. If the latter is allowed to accumulate near the hinge of the carrier ring it may cause a temporary jam.

The outer canvas of the obturating pad should be free from rents; small bruises likely to be removed by the pressure of firing are of no importance. The threads of the breech screw should be free from burrs; should the screw not work easily when the obturator has been detached, the defect may often be remedied by careful filing, but no portion of the thread should be cut away to remove a crack, &c.

### Vent.

Radial removable vents, owing to rapid scoring, require to be changed after a certain number of rounds varying from about 100 to 170 with P powder.

They should be taken out and examined if possible after the first 50 rounds, and again after every subsequent 25 rounds, by holding up to the light; if much eroded, others should be substituted. Should the gas have eaten through the vent bolt and eroded the gun, the defect, if small, is of slight importance, as a serviceable vent bolt will prevent further erosion.

Great care should be taken that the vent is properly screwed up, otherwise the rush of gas may cut through the copper washer and erode the gun so that the washer will no longer be effective in preventing the rush of gas, and the erosion will increase until the vent hole has been bushed.

On removing the vent, should any doubt exist as to its fitness for further firing, it should be replaced by a new one, care being taken that this is well tightened up, and that the copper washer is properly



placed. The vent nut is liable to be loosened by firing, and it is desirable that it should be tightened after the first round and subsequently if necessary.

### To Remove the Breech Fittings.

#### Obturator

Take off the clip which secures the outer end of the axial head, the obturator can then be withdrawn from the front of the breech screw, and the pad and discs removed from the head.

#### Breech Screw.

When the breech is open, the breech screw is held in the carrier ring by a stop bolt on the right, and by the "clip carrier ring" on the left, by lifting up the clip, and moving the breech screw forward, the stop bolt can be pushed out from behind; then by holding up the clip, the breech screw can be withdrawn from the carrier ring.

#### Carrier Ring.

This is attached to the breech by a hinge bolt secured by a keep pin: when the latter is taken out, the hinge bolt can be removed by giving it a few taps underneath with a piece of wood.

#### Clip, Carrier Ring.

This clip is held by an axis pin, on the removal of which the clip can be withdrawn.

#### Cam-Lever.

This lever is attached by a hinge bolt with keep pin: when the latter is removed, the bolt can be withdrawn.

#### Vent Bolt.

The vent is secured by a nut on the exterior; when this has been taken off, the vent can be pushed down and withdrawn from the interior of the gun.

---

# DESCRIPTION OF 12-PR. B.L. FIELD GUN CARRIAGES, WAGONS, AND LIMBERS.

## Carriage, Field, B.L. 12-pr., Mark I.

### *Plates IV and V.*

The carriage is formed of two bracket sides connected by transoms, bolts, and a trail plate; two axletree bearings, with removable axletree, and two field wheels.

The brackets are made of flanged steel plate, and are joined by a steel plate riveted along the centre of the under side. A trail box is formed between the brackets to carry two case shot, and two cartridges in a cartouche. The cartridges and case shot are not to be carried in these boxes when travelling, but should be taken from the wagon and put into them when going into action in order that the gun may then have six rounds with it. Provision is made in the lower part of the trail for carrying a leather box containing small stores, and a pad is fixed to the transom to support the breech of the gun, and thus prevent damage to the elevating gear when travelling.

The axletree bearings are of cast steel, and are fitted at the upper surface with bearings and capsquares for the gun trunnions.

The axletree is a steel forging, and is connected to the brackets by two tensile stays, fitted at the centre with a spiral spring in a box to give additional elasticity. The arms are 2nd class, having no shoulders.

The trail plate is of wrought-iron, the eye being fitted with a removable piece of hard steel.

The wheels are what is known as 2nd class, with pipe boxes 11 inches long. They are 5 feet in diameter, 3 inch tire. The flanges are of gun metal, and the tires of steel rounded off at the edge. The flanges are flush with the pipe box, as in the Indian pattern wheel; the rear flange is turned to take the friction brake. The tires are  $\frac{1}{8}$ " thick. The linch pins and drag washers are 2nd class,  $\frac{7}{8}$  inch in thickness, and are similar to the Indian pattern.

The naves are fitted with a self-acting friction brake to check the recoil, also a hand brake which can be applied or thrown out of gear when travelling. (*Plate V.*)

The brakes are adjusted by means of a screw bolt and nut, so that each wheel will support at its circumference a weight of 112 lb. The adjustment is effected by turning the bolt, which screws into a thread cut in the brake band; the nut is then tightened up to lock the bolt and prevent it getting slack.

The elevating gear consists of an arc attached to an eye on the gun, and geared to a pinion and worm wheel with friction cone, and is worked by a handle above the right bracket. The arc is fitted at the centre with a hinge joint to prevent injury, should it strike anything when travelling over rough ground.

When issued to the Royal Horse Artillery, a standard is fitted to each side, to which the ring is attached, which secures the brake lever when not in use.

The carriages when issued to Field Artillery are supplied with axletree seats, furnished with guard irons and leather guards; the seat is supported on three spiral springs, fitted on either side of the trail. A sliding step for each seat is fitted on the underside of the axletree.

A straight wooden handspike, which is also used as a rammer, fits into a socket between the brackets. In travelling it is strapped on the left bracket.

The carriage is fitted with a loop and hooks for a drag-shoe and chain, with locking plates, and with fittings for the small stores, as detailed in diagram, and a socket on the trail box for nutting up time fuzes.

### Carriage, Field, B.L. 12-pr., Mark II.

*Plates VI, VII, and VIII.*

The carriage is constructed principally of steel. Its chief features are a top carriage fitted with a hydraulic buffer to admit of the gun recoiling axially and so to lessen the shock of firing on the main carriage; a self-acting tire brake to check the recoil and for use by hand when travelling; and an arrangement for traversing the gun laterally (about  $4^{\circ}$ ) independently of the trail.

The carriage consists principally of two side brackets, an axletree of weldless steel tube forged at the ends to form 2nd class arms, two field wheels of the double spoke pattern, a gun cradle, a top carriage, elevating gear, and brake gear.

The gun is a close fit in the cradle to which it is secured by cap-squares fitting tightly over the trunnions. The breech end of the gun is fitted with a slipper guide which, together with the cradle, slides in guides formed on the upper part of the top carriage. The latter is pivoted at the front to the axletree and is supported by the elevating screw at the rear.

The hydraulic buffer is connected to the top carriage by trunnions, and the piston rod is connected with the breech end of the gun. This allows the gun about 4 inches recoil on the top carriage, during which the motion is gradually imparted to the whole structure, thus lessening the strains upon it due to firing.

The piston rod passes through both caps of the hydraulic buffer, and the gun is returned to the firing position by volute springs on the piston rod in front of the buffer cylinder.

The hydraulic buffer consists of a cylinder, piston, and rod of steel and a cap of gun metal. Each end of the cylinder is formed to take a U leather with metal ring, cotton packing, and a metal gland. A small spring bolt fitted to the buffer engages the rear gland to prevent it working loose, the front gland being held in position by the pressure of the volute springs.

The front cap is made to fit into a recess in the piston so as to form a small hydraulic cushion which prevents injury to the buffer by concussion caused by the return of the gun.

The bore of the cylinder is slightly tapered so that the space around the piston may form a varying orifice for the flow of the liquid; by this means an approximately constant pressure is maintained in the buffer throughout the stroke.

The gun is elevated by means of a screw (*a*) under the top carriage. The screw is actuated by a nut (*b*) which is revolved in a forged steel oscillating bracket by a bevel pinion (*c*) on the hollow shaft of the elevating hand-wheel (*d*).

The oscillating bracket of the elevating gear is moved laterally for traversing the gun by means of a screw (*e*) on the shaft of the traversing hand-wheel (*f*). This shaft revolves in a gun-metal

bracket on the right side of the carriage, and the screw works in a nut formed by one arm of the oscillating bracket.

This arrangement gives a lateral traverse of about 28 minutes for each turn of the hand-wheel. Above  $11^\circ$  elevation the traversing of the gun is limited by the top carriage coming into contact with the side brackets.

The brake consists of a tubular cross shaft (*g*) in two pieces working in brackets fixed to the carriage frames and having on each outer end a crank and brake block; this cross shaft is actuated by a lever (*h*) pivoted at (*i*), a spring tie rod (*k*), a crank (*l*), and a balance link (*m*), which ensures an equal pressure of the brake blocks on both wheels.

When the lever (*h*) is moved in the direction of the arrow, either by the rod (*n*) on the recoil of the gun, or by the hand lever (*o*) when travelling, the brake acts on the wheels and the pawls (*p*) engage with the teeth cut on the edge of the ratchet lever (*q*) and keep the brake in action.

The brake is released by pulling up the lever (*r*) which withdraws the pawls from the ratchet; the spring (*s*) then moves the lever (*h*) to its original position, and removes the brake blocks clear of the wheels.

The brake blocks can be thrown entirely out of use by lifting the pin (*t*) and turning the blocks through an angle of  $180^\circ$ .

## Limber, Marks I and II.

### Plate IX.

The limber is constructed of steel. The body consists of four futchells (flanged top and bottom), connected by a rear stay, a series of angle stays, and a hollow square splinter bar. Two wrought-iron stays are fixed to the outer futchells and the splinter bar. The four futchells gradually deepen towards the rear; in the deepest part holes are bored to suit the axletree.

A platform board and a footboard are bolted on the top of the futchells.

Fittings for securing the ammunition boxes are fixed to the platform board.

The axletree is a weldless steel tube, forged at the end with 2nd class arms. It is turned throughout, so that it can be readily removed from the limber and interchanged.

A wrought-iron limber hook (with removable steel) is rivetted to the rear stay and inner futchells. Fittings for single and double draught are fixed to the underside of the body.

The shafts are "near" and "off." The brandling iron of the "off" shaft is 2nd class, made to suit the 11" pipe box.

The ammunition boxes are of wood. A striking plate is fixed on the rear of each box to take the blow of the trail when "limbering up." The guard irons are cranked, and fitted with leather guards. The boxes are each secured by two nib irons and a thumb screw, and stops are fitted to the rear stay, to prevent the boxes breaking the thumb screws.

Each box is fitted internally with steel partitions to carry the projectiles, a proportion of small stores, and a canvas cartouche with cartridges. All the projectiles except star shell are carried vertically in wooden trays having recesses. The shells are steadied by wooden

blocks on the lids which fit over the heads. A leather holdall for small stores is screwed on to the inside of the lid. The oil-can is carried underneath on the off side, the grease tin on the near side, and a steel box fitted on the platform board on the near side to carry Scott's sight.

Mark II differs from Mark I, shown in plate, in having deeper futchells, and in having wheels of the double spoke pattern; thus the wheels of both Marks are interchangeable with those of their carriages, and the wheels of Mark I are fitted with the friction brake band.

										Mark I.	Mark II.							
										ft. in.	ft. in.							
Height to axis of gun	..	..	..	..	..	..	3	3½	..	3	4							
Length of	{ carriage	{ with wheels		..	..	..	9	8	..	9	5½							
		{ without wheels		..	..	..	8	1½	..	7	5							
	{ axletree	{ ..		..	..	..	6	3	..	6	2							
		{ carriage and	{ with gun..		..	..	..	23	4½	..	22	9						
{ limber	{ without gun		..	..	..	20	4½	..	20	2								
	Angle of trail	..	..	..	..	..	..	27°	..	23°								
										Degrees.	Degrees.							
Maximum elevation	..	..	..	..	..	..	16	..	15									
„ depression	..	..	..	..	..	..	8	..	5									
										ft. in.	ft. in.							
Wheels { track	..	..	..	..	..	..	5	2	..	5	2							
	{ diameter	..	..	..	..	..	5	0	..	5	0							
										cwts. qrs. lb.	cwts. qrs. lb.							
Weight (empty)	{ Carriage (without wheels)		..	6	3	24	..	7	0	20								
	{ Wheels (two)..		..	4	1	4	..	4	0	26½								
	{ Limber (without wheels)		..	4	0	24	..	4	0	24								
	{ Wheels (two)		..	4	1	4	..	4	0	26½								
	{ Boxes, limber (two)		..	2	1	17	..	2	1	17								
Total										..	..	22	0	17	..	22	1	2

### Ammunition Wagon, Marks I and II.

#### Plate X.

The wagon is constructed of steel, and is fitted with two ammunition boxes.

The body consists of a hollow box perch of ½" steel, two flanged sides, a rear flanged stay, and three transoms.

A platform board and a footboard are bolted to the futchells, and a steel spare wheel arm is rivetted to the perch.

A wrought-iron perch eye (with removable steel) is rivetted on the point of the perch, and locking plates are fixed near the centre.

A drag-shoe and chain is attached to a loop on the underside of the perch eye, and carried on the top of the perch, in which position it is secured by an iron loop and a leather strap.

Two wooden boxes for carrying 14-lb. grease tins are fixed by iron bands to the underside of the wagon.

The axletree and wheels are interchangeable with those of the limber, but the wheels of Mark I are not fitted with the friction brake band.

The ammunition boxes are similar in construction to those of the limber, but differ in the arrangement of the internal fittings.

Mark II differs from Mark I, shown in drawing, in having deepened futchells and wheels of the double spoke pattern.

		Mark I.			Mark II.		
		cwts.	qrs.	lb.	cwts.	qrs.	lb.
Weight (empty) with strapping boxes & grease tins.	Wagon (without wheels)	..	3	3 14	..	3	3 14
	Wheels (two) ..	..	4	0 20	..	4	0 26½
	Boxes, ammunition (two)*	..	2	1 16	..	2	1 16
	Limber (without wheels)	..	4	0 24	..	4	0 24
	Wheels (two) ..	..	4	0 20	..	4	0 26½
	Boxes, limber (two) ..	..	2	1 16	..	2	1 16
Total..		..	21	0 26	..	20	1 11

### Limber.

#### Plate IX.

The limber for the wagon is the same as that for the gun carriage and the ammunition boxes are similarly fitted.

NOTE.—The *angle of lock*—that is, the angle made by a line perpendicular to the front of the axle-tree bed of the limber, with a line in *prolongation* of the trail of the gun or perch of the wagon, when either wheel of the limber locks against the trail or perch, is as follows:—

Mark	I carriage and limber..	..	..	55°
„	II „ „	..	..	50°
„	I wagon „	..	..	62½°
„	II „ „	..	..	62½°

### Wagon Forge, R.A., Mark III.

#### Limber, Wagon Forge, R.A., Mark III.

The wagon consists of a frame of angle steel, a steel perch, a tubular axletree, and two field wheels.

The frame is fitted to carry four wood boxes, and a “Forge field, R.A., Mark V”; the boxes are secured in position by nib irons and thumb screws; the two front boxes are for tools, and the two side for coals. The forge is placed between the coal boxes, and secured when travelling by leather straps and the tailboard; when required for use the tailboard is turned down, and the forge, which is provided with rollers, is run out on the tailboard to facilitate removal. On the top of the front boxes are secured a lantern box (for two distinguishing lanterns) and a block for the anvil.

The perch is formed of plate steel, bent so as to form a tapering box girder, and fitted with a perch eye. It carries an anvil, a drag-shoe, two propsticks, and a nail anvil.

The axletree is the same pattern as that for the carriage limber.

The wheels issued with this wagon will be the same as those for the remainder of the equipment, viz., with Mark I carriages and limbers, “Wheel 2nd Class C., No 36”; with Mark II carriages and limbers, “Wheel 2nd Class C., No. 42.”

The wagon is fitted with four bale hoops, and a canvas cover.

The limber is the same as the carriage limber, but instead of the ammunition boxes it carries a long wooden box for stores. The fittings for securing the box are the same as those for the ammunition boxes.

Weight (empty) with strapping, boxes, } 35 cwt., 2 qrs., 4 lb.  
and grease tins, wagon and limber }

\* With cartouches and fuze tin.

Wagon Store, R.A., Mark II.  
Limber Wagon Store, R.A., Mark II.

"F" This wagon is similar to the forge wagon, but the body is fitted with four wooden boxes, secured by nib irons and thumb screws; the three front boxes are for carrying stores, and the rear box for stationery.

The limber is the same as that for the forge wagon, but the store box is different in its internal fittings.

Several "Wagons, Forge, R.A., Mark II," and "Wagons, store, R.A., Mark I," were issued with the first batteries of the Mark II equipment, in consequence of none of the above pattern wagons being manufactured at the time. These wagons are packed with the same description and number of stores, as laid down for the above wagons.

Weight, Store Wagon and limber (empty) } 34 cwt., 3 qrs., 9 lbs.  
with strapping boxes and grease tins }

GENERAL INSTRUCTIONS FOR CARE AND PRESERVATION  
OF CARRIAGE AND LIMBER.

Care should be taken that all nuts and screws are properly tightened up; if removed, they should be slightly oiled before being replaced, and to prevent damage by the threads crossing, a few turns should be given by hand before using the spanner.

On no account should a hammer be used in removing the nuts or screws.

All bright parts should be kept clean and slightly oiled to prevent rust.

All working parts must be kept free from clotted oil and dirt, and properly lubricated.

*When painting the carriage or limber, especial care should be taken not to paint those surfaces over which motion, whether lineal or circular, takes place.*

Before travelling, the wheels and axle arms should be freed from grit, the latter well greased, and all nuts properly screwed up with the spanners provided for that purpose.

Special for Mark I Carriage.

The brakes on the wheels are mainly intended for checking recoil, but they can be used as a travelling brake. They should, however, in travelling, be used sparingly and with judgment, otherwise there is a danger of the parts becoming heated and worn.

The box which contains the spring on the stay of the carriage should be periodically opened, and the spring examined and cleaned if necessary.

Particular attention must be paid to the elevating gear to preserve it in good order, and the friction cone should be occasionally removed and slightly oiled to prevent the formation of rust, which would cause it to get set fast in the arc pinion and so prevent it acting. Care must be taken in replacing the cone to see that it is properly adjusted to give the necessary slip for preventing injury to the gear.

When the requisite compression has been given by the inner nut, it should be held while the outer nut is screwed up against it.

The threads of the spindle carrying the adjusting nuts are not to be painted, but kept from rust with boiled linseed oil.



### Special for Mark II Carriage.

**Hydraulic buffer.**—The buffer must be kept fully charged with oil, and if necessary, small quantities can be poured in through the filling hole at the top of the buffer, by using the funnel provided. Great care must be taken that no dust or gritty matter is poured in with the oil. If any leakage of oil takes place at the glands these must be tightened, care being taken that before the rear gland is turned its securing bolt is first pressed down, and afterwards that it is properly locked in its new position. If this will not stop the leakage the buffer must be removed from the top carriage and its packings renewed.

To remove the buffer.—Place the gun at extreme depression, retaining it in that position by blocking up the top carriage. Remove the pin connecting elevating screw, and run the screw down into the nut. See that the buffer is supported, so that when the screws securing it to the top carriage are withdrawn, it will not fall. Withdraw the pin securing the gun to slipper sufficiently far to enable the cross head to fall clear. Replace the pin and remove the buffer from the carriage.

To pack the front gland.—Empty the buffer, unscrew the stop at the end of the piston rod and remove the volute springs. Unscrew the inner gland and slip it along the piston rod. Replace the defective packing with fresh material, which must be well saturated with Russian tallow before insertion. If the leather packing requires renewal it must be removed either by moving the piston rod or by unscrewing the outer gland; and in introducing the new leather care must be taken to preserve the edges from injury.

To pack the rear gland.—Remove the volute springs in the manner described. Pull the piston up to the rear end of the cylinder. Unscrew the gland and slip it along the rod and pack the gland as before described. If the leather packing requires renewal and cannot be removed by working the piston rod, knock out the pin retaining the crosshead and unscrew the latter. Remove the outer rear gland and pull the piston rod out of the cylinder.

If after recoil, the gun is not forced back into the firing position, increased spring power can be obtained by tightening up the nut at the forward end of the piston rod.

**Brake.**—If the releasing spring become slack and does not keep the blocks sufficiently far off the wheels, it may be adjusted by turning the collar by which it is attached to the hand lever shaft through a small angle; the collar is secured in position by a split pin which may be inserted in one of three holes drilled in the collar according to the amount of tension required on the spring.

When the brake-block leather is worn out, it must be removed and replaced by a new one. If the recoil of the gun is insufficient to bring the blocks hard on the wheels, the connecting rod should be adjusted so as to give the desired result. This is done by withdrawing the split pin at the end of the rod, screwing the rod sufficiently far into the sleeve and replacing the pin.

**Replace the joint pin.**—The brake on firing should do no more than just skid the wheels, and if it is found that with the brake put hard on by hand, there is a shorter distance than the length of recoil of the gun in the carriage, between the end of the link and the back of the cascade pin, the gear should be re-adjusted before firing.

The length of recoil is 4.25 inches.



PROJECTILES.  
Plates XI and XII.

				Diameter.		Length.	Bursting Charge.		Weight filled and fuzed.		
				Body.	Band or Studs.		Nature.	Weight.	lb.	oz.	
				in.	in.	in.		lb.	oz.	lb.	oz.
Shell	Common	Service I ...	...	2.97	3.085	11.3	P. & F.G.	1	8½	12	9
		Practice I ...	...	2.97	"	9.35	"	10	12	8	
	Shrapnel	Service I ...	...	2.97	"	8.25	L.G.	"	"	12	8
		Practice I ...	...	2.97	"	8.6	"	"	"	12	8
	Star II ...		...	2.97	"	11.3	...	...	9	3	
	Case I ...		...	2.96	"	8.5	...	...	2	15	
Shot...	Drill II ...		...	2.94	2.97	9.35	...	...	11	5	

Common Shell { Service Mark I.  
Practice Mark I.

There are two kinds of common shell, service and practice; the former, of steel, is for service and practice over land ranges; the latter, of cast-iron, is for practice over sea ranges only. The steel shell is forged from a disc of steel. A gun-metal bush, screwed to G.S. fuze-hole gauge, and long enough to take the G.S. wad under the small percussion fuze, is screwed into the head, and the space round the end which projects into the shell filled in with lacquer. The cast-iron shell is cast to dimensions, and has no bush. Both shells are lacquered inside and are fitted with a Vavasseur driving band with two cannellures, pressed into a groove 1 inch wide at a distance of 0.45 inch from the base end, by which rotation is imparted to the shell.

Shrapnel Shell { Service Mark I.  
Practice Mark I.\*

There are two kinds of Shrapnel shell, service and practice; the former, of steel, with bursting charge in the head, is for service and for practice over land ranges; the latter, of cast-iron, with bursting charge in the base, is for practice over sea ranges only.

The body of the service shell is made from steel tubing, the front end being reduced to the shape shown in the Plate by means of a punch and die. A gun-metal bush screwed to G.S. fuze-hole gauge, and long enough to take the G.S. wad under the time and percussion fuze, is screwed into the head, solder being run into the space between it and the head as high as the screw thread extends, so as to fix it more securely. A tin cup to carry the bursting charge is inserted from the base end, the neck fitting tightly round the end of the bush. The space round the neck is filled by a wood ring. A felt disc is placed next the tin cup, then one of wrought iron. The bullets are inserted and resin run into the interstices from the base, which is closed by a malleable cast-iron base piece, secured by screw rivets.

The practice shell is of the ordinary type, with bursting charge in the base, having a cast-iron body and Bessemer steel head.

Contents {	Service	177 (35 per lb.)	mixed metal balls.
	Practice {	72 (34 per lb.)	" "
		16 (84 per lb.)	" "

\* The existing stock of iron shrapnel will be used up, but over sea ranges only. No more will be manufactured.

### Star Shell. Marks I and II.

The body of the shell is of forged-steel, and has a recess in the base to contain the bursting charge, which consists of strands of quick-match sewn on to a disc of cartridge paper. A brass tube pierced with fire holes passes down the centre of the shell, and is screwed into a perforated disc above the recess. The head of the shell is made of Bessemer metal, with a gun-metal socket tapped to general service gauge, and pierced with fire holes. The head is secured to the body by four brass and four steel screws, the holes for the latter being slotted through to the rear so that the only effect of the screws is to prevent the head twisting off in flight.

The shell is fitted with a broad Vavasseur driving band of copper, with two cannellures, pressed into a groove near the base as shown in Plate XI.

The shell contains twenty-one stars in three layers, the bottom and centre layers having seven large stars each, and the top layer seven small ones.

Weight of shell, including fuze, 9 lb. 3 oz.

Very few Mark I shell have been made.

Mark II differs from Mark I in being 10 oz. heavier, having a small bursting charge at its base, contained in a shalloon bag, the stars primed with sulphur, and four holes bored through each end of the cases containing the stars.

The shell require no preparation for use except fuzeing.

The following table gives the setting of middle sensitive time fuze and the number of degrees of elevation at which the gun (with 10 oz. R.L.G.<sup>2</sup> charge) must be laid to obtain a burst of star shell at an effective height, for three ranges:—

Range.		Elevation.		Fuze Scale.
700 yards	...	16° 30'	...	8
1250 "	...	17° 30'	...	14
1580 "	...	20°	...	20

### Case Shot.

The body of the case is made of tin, in three longitudinal pieces, lap-jointed and soldered together. It is lined with three longitudinal segments of sheet-iron, 0·083" thick. The top is made of sheet-iron, tinned, 0·049" thick; the bottom is made of tin, with a disc of sheet-iron, 0·109" thick, laid loose inside. A copper ring of the form shown in the Plate, is secured to the base end by six iron rivets, and three studs of mixed metal (to act as stops when loading) are fixed round the body at the base end, in front of the copper ring.

Contents—				Lb.	oz.
314 mixed metal balls,	34	per lb.	...	9	4
Clay and sand	...	...	...	1	0

### Drill Shell.

The drill shell is made of cast-iron, similar to the practice common shell (Plate XI), but smaller in diameter and with a front copper band, 5" wide and 6·25" from the base, to prevent the iron of the

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shell coming into contact with and injuring the bore. Both copper bands are plain and are small enough to allow of the shell being rammed through the gun. This shell supersedes the Shot Drill, Mark I (§ 5146).

NOTE.—Each subdivision, in addition to the above, will keep one service shrapnel and one service common shell emptied for instructional purposes. These should be marked "E" in red to avoid risk of accidents, the red band denoting "filled" being obliterated, and also date of filling.

## DIRECTIONS FOR FILLING SHELL.

### Common Shell.

Drop in a portion of P powder, and tap the outside of shell with a wooden mallet, put in a portion of the R.F.G. powder, tap with mallet again, and repeat operation until the whole of the bursting charge is in; unless this is carefully done, difficulty will be experienced in getting the whole of the bursting charge into the shell. Then insert the G.S. papier-maché wad with the side on which the shalloon is cemented downwards, *i.e.*, next the powder; drive it in with the "drift, G.S." as far as the shoulder on the drift will allow, and screw in the plug or fuze as required.

The proportions of the bursting charge are  $18\frac{1}{2}$  oz. P. to 6 oz. FG. for service shell, and  $7\frac{1}{2}$  oz. P. to  $2\frac{1}{2}$  oz. F.G. for practice shell.

### Shrapnel Shell.

For the service shell pour the bursting charge into the tin cup, and insert a G.S. wad and then the plug or fuze as required, care being first taken to see that the threads of the fuze-hole are free from powder.

For the practice shell pour the bursting charge gradually into the shell by means of the leather funnel, shaking the shell from side to side on its base till the whole has passed down the tube. Drop in the metal primer, and by means of the large Shrapnel screwdriver, screw it tightly into the tube. Then screw in the fuze or plug as required.

### Fixing Plugs and Fuzes.

When plugs or metal fuzes are screwed into shells they will be lubricated with Field's grease, No. 3, if for use at home stations or in British North America. For all other stations Price's composite grease will be employed.

The "Key, fuze and plug, G.S.," the "Key, plug, G.S.," or the "Key, fuze, universal," are the only implements which should be used for screwing in the G.S. plug.

## DISTINGUISHING MARKS.

All shrapnel shell will be painted with a red tip 1 inch deep.

All steel shot or shell will have a white band  $\frac{1}{2}$  inch wide painted round the head 1 inch from top; in the case of shrapnel this white band will be immediately below the red tip. F.S. will be stamped on the base of forged steel projectiles.

All filled shell will have a red band  $\frac{1}{2}$  inch wide painted round the head  $1\frac{1}{2}$  inch from the top; in the case of steel shell this band will be immediately below the white band, and in the case of cast-iron shrapnel it will be  $\frac{1}{2}$  inch below the red tip. They will be marked with the date of filling, and also the monogram of the station, except when filled by the Royal Artillery. Filled shell will be marked with the date, and with the letter P., if filled with P. and F.G. mixture. The colour of the paint will be red on a black ground, and black on a red ground.

Projectiles which are to be used for practice only will be marked with a yellow band,  $\frac{1}{2}$  inch wide, round the body.

Shells which have been emptied will be marked on the head with the letter E in red paint, and the monogram of the station.

## EXAMINATION OF SHELLS

## Common.

Remove the fuze-hole plug, pass the "metal hook for removing wads" through the hole in the centre of the wad, and draw the wad out of the fuze-hole; if the powder charge is in a serviceable condition insert a new papier-mâché wad, and replugin the shell as directed in instructions for filling. If the powder charge is found to be caked from the effects of damp, empty the shell and clean it out. If the powder is so caked that it will not run out of the shell, or if any powder remains adhering to the interior of the shell, fill the shell with boiling water and allow it to stand for about five minutes, then pour out the water and fill up again with boiling water. After standing for fifteen minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until after fifteen minutes have elapsed after the second quantity of boiling water has been poured in. If necessary, the addition of boiling water will be repeated until the whole of the bursting charge has been extracted. When the shell is perfectly dry, refill with serviceable powder.

## Shrapnel Practice.

Remove the fuze-hole plug, unscrew the primer with the "large screw-driver," and lift out the primer with the "metal pincers for removing primers"; turn the shell nose downwards, and if the powder charge flows out and is serviceable, refill and replace primer and plug; the shell should be well shaken if the powder does not come out quite freely, as a portion of the powder may possibly be jammed in the tube; if the powder cannot be extracted as above, being caked from the effects of damp, &c., the primer and plug will be replaced, and steps taken for the exchange of the shell.

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## FUZES.

*Plates XIII to XVII.*

Fuze, Percussion, Small. Marks I,\* II,\* and III  
No. 8.

Fuze, Time and Percussion, Short. \*Marks I\* and II.  
No. 55.

‡Fuze, Time and Percussion, Middle. Mark I. No. 54.

||Fuze, Time, Sensitive, Middle. Mark I. No. 24.

Description of Fuze, Percussion, Small. Mark I\*.

*Plate XIII.*

The fuze, which is tapped on the exterior to the G.S. pitch and taper, consists of the following parts: Body; detonator pellet (*a*); safety pellet (*b*); ball (*c*); retaining bolt of gun-metal (*d*); closing pellet of lead and tin (*e*); needle of steel, (*f*), with roughened point; safety pin (*g*), shearing wire (*h*), and cap of copper. The detonating composition in the latter covered with a paper disc, and a brass disc .01" thick. There is a small brass spring (*i*) to hold the retaining bolt in its place, and a small gun-metal set screw (*k*) to keep the detonator pellet from revolving independently of the body of the fuze. The detonator pellet and bottom plug contain powder.

These parts are all shown in the Plate.

*Preparation and Firing.*

Remove the G.S. plug, insert the fuze and screw it home, using the "Key, fuze, universal," which fits two slots cut in the head of the fuze.

Remove the safety pin at the moment of loading.

*Action.*

On shock of discharge, the safety pellet (*b*) shears its wire (*h*) and falls to the bottom of the recess shown in the plate. This allows the ball (*c*) to fall on to it into the same recess.

The rotary motion of the shell now causes the closing pellet (*e*) to move outwards and close the top of the recess, and also the retaining bolt (*d*) to overcome the force of the spring (*i*). There is now nothing to prevent the detonator pellet (*a*) moving forward on to the needle (*f*), which it does on the graze or impact of the shell, firing the cap and powder in powder channel and bottom plug, the flash then passing to bursting charge of shell.

† The Mark I\* will probably be shortly declared obsolete.

‡ For use at long ranges. This fuze is obsolete for future manufacture.

|| For use with Star Shell.

## Description of Fuze, Percussion, Small. Mark II\* and III.

### Plate XIV.

The fuze consists of the following parts:—

Body, detonator pellet, with two retaining bolts, spiral spring, safety pin, closing pellet, needle plug, and magazine.

The body is of gun-metal, and is screwed on the outside to the general service taper, except the lower end, for a length of  $\cdot 3$  inch, which is reduced in diameter. It is bored out from the top to receive the detonator pellet, and is closed by means of the needle plug. Two holes, closed on the outside by brass discs, are bored in the body to receive the retaining bolts of the pellet, and a groove is cut in the body behind the head of each bolt to allow it to spin out. Two fire-holes are bored in the bottom to communicate the flash from the pellet to the magazine, which consists of a pierced pellet of pressed powder, secured in the lower end of the fuze by a brass disc span in.

The pellet of gun-metal has a detonator, secured in a recess in the top, from which two fireholes are bored to the bottom; these fireholes are filled with F.G. powder, and closed at the bottom with paper discs. The top of the pellet is reduced to fit inside a spiral spring, which prevents the pellet rebounding or working forward during flight.

The two retaining bolts, with brass spiral springs, pass transversely through the pellet (as shown in the drawing), the springs keeping them locked in the holes in the body until spun out by the rotation of the shell. A screw in the body projects into a groove down the side of the pellet, and prevents it from turning.

The needle plug has a steel needle fixed in the centre, and screws into the top of the body. A hole through the side of the fuze into the needle plug contains a brass pellet, with spiral spring behind it, for closing the safety pinhole.

The safety pin, of twisted copper wire, passes through the needle plug, down one of the longitudinal grooves in the body, behind the head of one of the retaining bolts, and is bent over at the top into a groove in the needle plug. An elongated eye is formed on the outside end of the pin, to which is attached a loop of blue braid, shellaced or glued down upon the top of the fuze, for withdrawing the safety pin.

Mark III. differs from Mark II. in having a weaker spring in front of the detonator pellet. All Mark II. will be withdrawn and exchanged for Mark II.\* or III. Mark II. will then be converted and reissued as Mark II.\*

### *Action of the Fuze.*

The safety pin being withdrawn at the moment of loading, the hole is closed by the closing pellet. On discharge, the centrifugal motion of the shell causes the retaining bolts to fly outwards, leaving the detonator pellet free to move forward. On impact, the pellet compresses the spring in front of it, and moves forward on to the needle, which ignites the detonator, and so fires the fuze.

To open the fuze for examination, the safety pin and closing pellet must be withdrawn before the needle plug can be unscrewed.

## Description of Fuze, Time and Percussion, Short. Mark I\*.

### *Plate XV.*

The fuze is made of gun-metal, turned all over and screwed to suit G.S. fuze-hole; the interior is bored out at the lower end and fitted with a needle (*g*), detonator pellet (*n*), retaining bolt (*m*), safety pellet (*i*), and brass ball (*l*), and the bottom closed with a gun-metal screw-plug and shalloon discs. The fuze is fitted with a composition ring (*d*) made of gun-metal, with a stem containing a hammer and needle (*c*) suspended by a copper shearing wire (*b*) 0.22" diameter over a detonator covered by a brass disc; a dome is fitted over the composition ring and secured by a cap screwed on the stem of body of fuze. The fuze has two safety pins (*a a*), one through the safety pellet (*i*) and one through the lighting needle (*c*), each having a loop of string attached.

### *Preparation and Fixing.*

Insert the point on the hemispherical arm of the "Key, fuze, universal," in the small hole in the circumference of the body of the fuze, and screw the latter tightly into the G.S. fuze hole.

The fuze should be set after it is fixed in the shell.

### *To Prepare it as a Time Fuze.*

Loosen the hexagonal cap on the top of the time fuze by means of the slot in one of the arms of the key, which will fit over it, and then turn the dome and collar of the fuze together until the required graduation on the collar coincides with the arrow-head on the body, and tighten the cap. This should be done *before the removal of the upper safety pin*, great care being taken that the ring is properly placed inside the seat formed by the projecting rim round the body, and that it is not tilted on one side. The nut should be screwed down as tightly as possible.

### *Withdrawing Safety Pins.*

If required to act as a time and percussion fuze, withdraw both safety pins just before inserting the shell; if the percussion arrangement is not required to act, the lower safety pin should be left in; if the fuze is required to act on *percussion only*, the upper safety pin should *not* be removed, and the arrow-heads should be set to coincide. If the fuze is not fired the safety pins must be replaced.

### *Action.*

The fuze is screwed into the nose of shell, and the safety-pins (*a a*) withdrawn at the moment of loading. On shock of discharge the wire (*b*), through lighting needle (*c*), is sheared, and the needle (*c*) ignites the composition in ring (*d*), which burns (according to graduation) until it reaches the meal-powder pellet (*e*), which it ignites, firing the magazine (*f*), the flash then passing through the holes in head of needle (*g*), fires the fuze.

### *When Used as a Percussion Fuze.*

On shock of discharge the wire (*h*) is sheared, causing the safety pellet (*i*) to fall into the pocket (*k*), thus releasing the ball (*l*); the centrifugal motion then causes the locking bolt (*m*) to fly out,



releasing the detonator pellet (*n*), which, being free to move forward (on impact), strikes the point of needle of the needle plug (*g*), thus igniting the detonating composition, and firing the fuze.

### Description of Fuze, Time and Percussion, Short. Mark II.

#### Plate XVI.

This differs from Mark I\* as follows:—

The safety pin of the time arrangement passes through the ring and under the hammer, instead of through the dome. This enables the dome to be stamped out of sheet brass instead of being cast.

The holes left by the safety pins are closed by brass pellets having spiral springs behind them, as the lead pellets used in previous pattern do not always set back correctly.

The upper surface of the body is not recessed for the composition ring, the latter being kept central by three projections on its inner face, which fit closely round the stem of the body. This ensures the ring having an even bearing on the body.

The composition in the ring is slower burning, the time of burning at rest is 12.2 to 12.8 seconds, when set at 18 or full length.

### Description of Fuze, Time and Percussion, Middle. Mark I.

#### Plate XIV.

The fuze is of the form and dimensions shown in the drawing, the percussion arrangement being similar to that of the small percussion fuze, Mark I.\*

The time arrangement consists of the body, composition ring, dome, and cap. All these parts are of gun-metal or brass.

The upper surface of the body is covered with a paper washer and then a calfskin washer attached by shellac.

The body is hollow, and its sides are pierced with three fire holes; the top of it is screwed to receive a hexagonal cap. The cap, which fits the hexagonal hole in the centre of the "Key, fuze, universal," has four escape holes. The composition ring has an annular groove round it for the composition, a projection on the upper side contains the hammer with steel needle, suspended by a .022-inch wire, and a detonator under it for lighting the composition in the ring. The hammer is also secured by a safety pin passing under it, the hole in the ring left by its withdrawal being closed by a brass pellet with a spiral spring above it.

The ring is kept in position by three projections on the inside, which fit closely round the stem on the body. An escape hole is bored through the top of the ring at the commencement of the composition, and three radial ones are bored through the inner side at equal distances round it.

The top and first radial holes are covered with paper, the two other radial holes with asbestos. The ring is graduated in even numbers from 0 to 30, and has an arrow-head between the last graduation and the commencement, to show the position of safety.



The body has an arrow-head on it for setting the fuze, opposite which is a hole from the surface to the percussion arrangement filled with powder for communicating the flash when the composition has burnt to it.

A small hole in the side is to receive the pin in the semicircular arm of the universal fuze key (§ 4924) when screwing the fuze into the shell.

The fuze is stamped T on the ring close to the "time" safety pin, and P on the body close to the "percussion" pin to distinguish them. If the fuze is required to act as a percussion fuze only, the P pin should be withdrawn, if as a time fuze only, the T pin, and if as a time and percussion fuze, both pins.

To set the time arrangement of the fuze the nut is loosened with the "Key, fuze, universal," and the ring moved round until the required graduation is opposite the arrow on the body, the nut is then tightened, great care being taken that it is screwed down as tightly as possible.

The time of burning at rest when set at 30 or full length is from 17.8 to 18.4 sec.

The action of the time arrangement is that, on discharge, the hammer sets back, shearing the suspending wire and fires the detonator, which lights the end of the ring composition; this burns until the channel communicating with lower part of the fuze is reached, when the flash passes down it and fires the detonator and magazine in the percussion arrangement.

Each fuze is wrapped in brown paper packed in hermetically closed tin cylinders.

## Description of Fuze, Time, Sensitive, Middle. Mark I.

### Plate XVII.

The fuze consists of the following parts:—

Body (a) with stem, lighting pellet (b), two retaining pellets (cc), two spiral springs (dd), needle (e), composition ring (f), dome (g), cap (h), two safety pins (ii), base plug (k), and axial magazine filled with M.G.<sup>1</sup> powder (l).

All the parts are made of gun-metal, except the composition ring, which is made of phosphor-bronze.

The composition ring is graduated on its periphery from 0 to 30, and reads to quarter units. An  $\Psi$  is stamped on the ring to show the safety point, and when this coincides with the  $\Lambda$  on the body the fuze is set at safety. The cap, which screws on to the top of the pillar, is made hexagonal, to fit the "Key, fuze, universal."

The fuze is set by loosening the screw cap (h) on the top of stem, by means of the "Key, fuze, universal," (§ 4934), and turning the dome and ring till the required graduation on the collar coincides with the arrow-head on the body; then tighten the screw cap. The safety pins are withdrawn at the moment of loading. On discharge, the centrifugal action causes the retaining pellets to fly out, releasing the lighting pellet, which flies out by centrifugal force against the needle, firing the detonator, which ignites the powder in the pellet and axial magazine, this latter lighting the quick-match in the composition ring.

## CHARGES.

Cartridges  $\left\{ \begin{array}{l} 4 \text{ lb. S.P. Mark I.} \\ 1\frac{1}{2} \text{ lb. blank. Mark II.} \\ 10 \text{ oz. R.L.G.}^2, \text{ for use with Star Shell. Mark II.} \end{array} \right.$

## Plate XI.

The service charge is 4 lb. S.P. (selected pebble). Cartridge, No. 2 silk cloth; choked with silk twist; hooped with 10\* blue worsted braids.

The saluting charge is 1 lb. 8 oz. blank L.G. cartridge, No. 1 silk cloth; choked with silk twist; hooped with three silk braids, and with a silk braid loop attached to the bottom for removing it from the gun if necessary. It is conical in form to prevent its being pushed beyond the vent, which projects a little into the bore.

The 10 oz. cartridge is made of shalloon, hooped with six worsted braids, and is marked with the nature of the gun and projectile with which it is used.

		Service.	Saluting.	10 oz.
Length .. ..	..	11.25" to 11.75"	5.75" to 6.25"	7.5"
Diameter $\left\{ \begin{array}{l} \text{top} \\ \text{bottom} \end{array} \right\}$ ..	..	3.45"	3.6"	1.9"

## Cartridge, Drill, Raw Hide, B.L., 12-pr., 4 lb.

This cartridge is made of a block of wood, with a hole bored in the centre, which is filled with cast-iron to bring the cartridge to its proper weight. It is covered with raw hide. A handle of tarred rope is attached to one end, the rope passing through two holes leading from the end and out at the sides of the cartridge where the ends are knotted.

Diameter, 3.45."  
Length, 11.5"

The drill shot and cartridge are carried in the trail box in Mark I equipment.

## DIRECTIONS FOR MAKING UP CARTRIDGES (B.L.).

(See *Regulations for Magazines*, 1887.)

## Filling.

Care will be taken to see that the empty cartridges are properly dry before being filled; the proper charge will then be carefully weighed out and inserted in the cartridge by means of the "Funnel, copper, cartridge." Cartridges will be choked by drawing together the mouth of the cartridge into several pleats with a nickle silver needle, threaded with two strands of silk twist; after drawing together the mouth of the cartridge, three turns will be taken round the pleats,

\* In future manufacture there will be 9 braids, as the bottom braid will be removed, this braid being apt to get under the vent and cause miss fires.

and the choke thus formed will be further secured by passing the needle three times through it alternately above and below the turns, thereby stitching down the turns round the choke at two points equidistant from each other.

### Hooping.

The cartridges will be made up to their proper lengths and diameters by means of the hoops, which should be drawn tight so as to make a firm cartridge, which is particularly necessary for the saluting cartridge.

Draw the braid through the silk cloth until the knot of the loop comes home to the silk cloth, the single end being already passed through the loop from underneath, pass the single end to one side of and under the loop, then draw the loop tight, and keep it so by placing the forefinger of the left hand firmly on the loop; bring the running end between itself and the loop, and draw tight the single bend thus formed, *taking care that the bend bites on the loop and not on the single end*, otherwise the knot will slip. The maintenance of the proper form of the cartridge depends on the hooping being thus secured.

### Marking Filled Cartridges.

All filled cartridges will have the initial or monogram of the station at which they are filled, stamped on the bottom end.

The cartridges filled by the Royal Artillery will be distinguished by having no initial letter stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department.

The initials and monograms used at the several stations are laid down in List of Changes §§ 1633, 2294, 3564, and 5830.

All cartridges will be very carefully examined and gauged as to length and diameter previous to packing.

### Tubes.

Tube friction copper short.

Tube friction copper solid drawn.

The present store of the former pattern will be first used up.

RANGE TABLE FOR 12-PR. B.L., MOUNTED ON MARK I CARRIAGE, BASED  
ON PRACTICE OF OCTOBER, 1884, MARCH AND MAY, 1885.

Charge, 4 lb. S.P. Gravimetric density,  $\frac{29.5}{0.940}$   
Projectile, Wt. 12.5 lb.  
M.V., 1710 to 1730 f.s. Jump 22 minutes.

Range.	Elevation.	Angle of descent.	Remaining velocity.	5 minutes' elevation in- creases or decreases the range by	5 minutes will alter point of impact vertically or laterally at each range.	50 per cent. of rounds should fall within			Time of flight.	Fuze scale, time and percussion, short.		Fuze scale time and per- cussion middle. Mark I.
						Length.	Breadth.	Height.		Mark I.	Mark II.	
yds.	°	'	f.s.	yds.	yds.	yds.	yds.	yds.	secs.			
0	0	0										
100	0 17	0 6	1659	74	0 14	21	0 04	0 04	0 19	—	—	—
200	0 11	0 12	1609	71	0 29	24	0 09	0 09	0 38	1 0	—	—
300	0 5	0 19	1550	69	0 43	23	0 14	0 14	0 57	1 5	—	—
400	0 2	0 26	1501	67	0 58	23	0 19	0 19	0 76	2 0	1 1	—
500	0 9	0 35	1463	66	0 72	22	0 24	0 24	0 95	2 5	2 0	—
600	0 17	0 44	1420	64	0 87	22	0 29	0 29	1 18	3 1	3 0	—
700	0 25	0 54	1378	62	1 01	22	0 34	0 34	1 40	3 6	3 5	—
800	0 33	1 5	1337	61	1 16	21	0 39	0 39	1 62	4 2	4 1	—
900	0 42	1 16	1294	59	1 31	21	0 45	0 45	1 84	4 7	4 6	—
1000	0 51	1 28	1253	57	1 45	20	0 50	0 51	2 06	5 3	5 2	—
1100	1 1	1 41	1220	55	1 60	20	0 55	0 57	2 32	5 8	5 7	—
1200	1 11	1 54	1188	53	1 74	20	0 62	0 64	2 58	6 4	6 3	—
1300	1 21	2 8	1156	51	1 89	20	0 68	0 71	3 24	7 0	6 5	—
1400	1 31	2 23	1124	49	2 03	19	0 75	0 79	3 50	7 6	7 5	—
1500	1 42	2 38	1092	47	2 18	19	0 81	0 88	3 34	8 2	8 1	—
1600	1 52	2 54	1072	45	2 32	19	0 88	0 98	3 63	8 7	8 6	—
1700	2 3	3 11	1052	44	2 47	20	0 95	1 10	3 91	9 3	9 2	—
1800	2 14	3 29	1030	42	2 61	20	1 02	1 20	4 19	9 9	9 8	—
1900	2 26	3 47	1011	41	2 76	20	1 10	1 35	4 47	10 6	10 5	—
2000	2 38	4 6	993	40	2 91	21	1 18	1 50	4 75	11 2	11 1	12 0
2100	2 50	4 25	978	39	3 05	21	1 26	1 70	5 16	11 9	11 8	12 6
2200	3 3	4 45	963	38	3 20	21	1 34	1 80	5 36	12 6	12 5	13 3
2300	3 16	5 6	948	37	3 34	21	1 43	2 00	5 66	13 2	13 1	14 0
2400	3 29	5 27	933	36	3 49	22	1 52	2 20	5 96	13 9	13 8	14 7
2500	3 42	5 50	919	35	3 63	22	1 61	2 40	6 26	14 6	14 5	15 4
2600	3 55	6 14	906	34	3 78	23	1 70	2 60	6 62	15 3	15 2	16 1
2700	4 9	6 39	893	33	3 92	23	1 80	2 80	6 98	16 0	15 9	16 8
2800	4 23	7 3	880	33	4 07	24	1 90	3 00	7 34	16 7	16 6	17 5
2900	4 37	7 29	868	32	4 21	24	2 01	3 20	7 70	17 5	17 4	18 1
3000	4 51	7 55	856	32	4 36	25	2 12	3 50	8 05	—	18 1	18 8
3100	5 6	8 21	844	31	4 51	25	2 23	3 80	8 42	—	18 7	19 5
3200	5 22	8 48	833	31	4 65	25	2 34	4 00	8 79	—	19 3	20 2
3300	5 39	9 16	822	29	4 80	26	2 45	4 30	9 16	—	19 9	20 9
3400	5 56	9 45	811	29	4 94	26	2 57	4 60	9 52	—	20 5	21 6
3500	6 12	10 16	800	28	5 09	27	2 69	5 00	9 88	—	21 1	22 3
3600	6 29	10 46	790	27	5 23	27	2 82	5 40	10 27	—	21 7	23 0
3700	6 46	11 17	780	27	5 38	28	2 96	5 80	10 66	—	22 3	23 6
3800	7 4	11 49	770	26	5 52	28	3 08	6 10	11 04	—	22 9	24 3
3900	7 22	12 22	760	26	5 67	29	3 23	6 40	11 42	—	23 5	25 0
4000	7 41	12 55	750	25	5 81	29	3 38	6 80	11 80	—	24 1	25 7
4100	8 0	13 31	741	25	5 96	30	3 54	7 20	12 20	—	24 7	26 4
4200	8 19	14 7	732	24	6 11	30	3 70	7 70	12 60	—	25 3	27 1
4300	8 40	14 44	723	24	6 25	30	3 87	8 20	13 00	—	25 9	27 8
4400	9 0	15 22	714	23	6 40	30	4 05	8 60	13 40	—	26 5	28 5
4500	9 21	15 59	705	23	6 54	31	4 20	9 10	13 80	—	27 1	29 1
4600	9 42	16 40	696	22	6 69	—	—	—	14 25	—	27 7	29 8
4700	10 3	17 20	687	21	6 83	—	—	—	14 72	—	28 3	30 5
4800	10 25	18 1	679	21	6 98	—	—	—	15 18	—	28 9	31 2
4900	10 48	18 42	671	20	7 13	—	—	—	15 64	—	29 5	31 9
5000	11 11	19 23	663	20	7 27	—	—	—	16 10	—	30 1	32 6
5100	11 34	20 4	655	20	7 42	—	—	—	16 55	—	30 7	33 3
5200	11 57	20 46	647	19	7 56	—	—	—	17 00	—	31 3	34 0
5300	12 22	21 30	639	19	7 71	—	—	—	17 45	—	31 9	34 7
5400	12 48	22 16	631	19	7 85	—	—	—	17 90	—	32 5	35 4
5500	13 14	23 3	623	18	8 00	—	—	—	18 35	—	33 1	36 1
5600	13 40	23 55	615	18	8 14	—	—	—	18 81	—	33 7	36 8
5700	14 7	24 44	607	18	8 29	—	—	—	19 26	—	34 3	37 5
5800	14 35	25 36	599	17	8 43	—	—	—	19 71	—	34 9	38 2
5900	15 2	26 30	592	17	8 58	—	—	—	20 16	—	35 5	38 9
6000	15 30	27 25	585	17	8 73	—	—	—	20 61	—	36 1	39 6

N.B.—Owing to the large jump, depression will have to be given up to 360 yards range.

RANGE TABLE FOR 12-PR. B.L. GUN ON MARK II. CARRIAGE.  
REVISED FROM PRACTICE OF APRIL, JULY, AND AUGUST, 1890.

Charge, 4 lb. S.P.  
Projectile, weight, 12.5 lb.  
Muzzle velocity, 1,710 f.s.

Gravimetric density.  $\frac{29.5}{0.940}$   
Jump, nil.

Remaining velocity. f.s.	Slope of descent.		5 mins. elevation or depression alters point of impact		Deflection for drift (telescope sight only). mins.	Elevation. °	Range. yds.	Fuze scales. Short time and percussion.		Fuze scale, time and per- cussion, middle.	50 per cent. of rounds should fall within			Time of flight. secs.
	1 in.	yds.	In range. yds.	Vertically. yds.				Mark I.*	Mark II.		Length. yds.	Breadth. yds.	Height. yds.	
2659		74	0-14	4	0	6	100	—	—	—	24	0-04	0-04	0-19
1609		71	0-29	4	0	13	200	1-0	—	—	24	0-09	0-09	0-38
1550		69	0-43	4	0	19	300	1-5	—	—	23	0-14	0-14	0-57
1501		67	0-58	4	0	26	400	2-0	1-1	—	23	0-19	0-19	0-76
1463	98	66	0-72	4	0	32	500	2-5	2-1	—	22	0-24	0-24	0-95
1420	78	64	0-87	4	0	39	600	3-1	2-6	—	22	0-29	0-29	1-18
1378	63	62	1-01	4	0	47	700	3-6	3-1	—	21	0-34	0-34	1-40
1337	53	61	1-16	5	0	55	800	4-2	3-6	—	21	0-39	0-39	1-62
1294	46	59	1-31	5	1	12	1000	5-3	4-1	—	21	0-45	0-45	1-84
1253	39	57	1-45	5	1	20	1100	5-8	4-5	—	20	0-50	0-50	2-06
1220	34	55	1-60	5	1	29	1200	6-4	5-0	—	20	0-55	0-55	2-32
1188	30	53	1-74	5	1	38	1300	7-0	5-5	—	20	0-62	0-62	2-58
1156	27	51	1-89	6	1	48	1400	7-6	6-0	—	20	0-68	0-71	2-84
1124	24	49	2-03	6	1	58	1500	8-2	6-5	—	19	0-75	0-79	3-09
1092	22	47	2-18	6	2	8	1600	8-7	7-0	—	19	0-81	0-86	3-34
1072	20	45	2-32	6	2	18	1700	9-3	7-5	—	19	0-88	0-98	3-63
1052	18	44	2-47	6	2	28	1800	9-9	8-0	—	20	0-95	1-10	3-91
1030	16	42	2-61	7	2	39	1900	10-6	8-5	—	20	1-02	1-20	4-19
1011	15	41	2-76	7	2	51	2000	11-2	9-0	—	23	1-10	1-33	4-47
993	14	40	2-91	7	2	61	2100	11-9	10-1	12-0	21	1-18	1-50	4-75
978	13	39	3-05	7	3	73	2200	12-6	10-6	12-6	21	1-26	1-70	5-16
963	12	38	3-20	7	3	85	2300	13-2	11-1	13-2	21	1-34	1-80	5-36
948	11	37	3-34	8	3	97	2400	13-9	11-6	14-0	21	1-43	2-00	5-66
933	10-5	36	3-49	8	3	109	2500	14-6	12-1	14-7	22	1-52	2-20	5-96
919	10	35	3-63	8	3	121	2600	15-3	12-6	15-4	22	1-61	2-43	6-21
906	9	34	3-78	8	4	133	2700	16-0	13-1	16-1	23	1-70	2-60	6-62
893	8-5	33	3-92	9	4	145	2800	16-7	13-6	16-8	23	1-80	2-80	6-98
880	8	33	4-07	9	4	157	2900	17-4	14-1	17-5	24	1-90	3-00	7-34
878	7-5	32	4-21	9	4	169	3000	18-1	14-6	18-1	24	2-01	3-21	7-70
856	7	32	4-36	10	5	181	3100	18-8	15-1	18-8	25	2-12	3-50	8-05
844	7	31	4-51	10	5	193	3200	19-5	15-6	19-5	25	2-23	3-80	8-42
833	6-5	31	4-65	11	5	205	3300	20-2	16-1	20-2	25	2-34	4-00	8-79
822	6	29	4-80	11	5	217	3400	20-9	16-6	20-9	26	2-45	4-30	9-16
811	6	29	4-94	12	6	229	3500	21-6	17-1	21-6	26	2-57	4-60	9-52
800	5-5	28	5-09	12	6	241	3600	22-3	17-6	22-3	27	2-69	5-00	9-88
790	5-5	27	5-23	12	6	253	3700	23-0	18-1	23-0	27	2-82	5-40	10-27
780	5	27	5-38	13	7	265	3800	23-6	18-6	23-6	28	2-96	5-80	10-66
770	5	26	5-52	13	7	277	3900	24-3	19-1	24-3	28	3-08	6-10	11-04
760	4-5	26	5-67	14	7	289	4000	25-0	19-6	25-0	29	3-23	6-40	11-42
750	4-5	25	5-81	14	8	301	4100	25-7	20-1	25-7	29	3-38	6-80	11-80
741	4	25	5-96	14	8	313	4200	26-4	20-6	26-4	30	3-54	7-20	12-20
732	4	24	6-11	15	8	325	4300	27-1	21-1	27-1	30	3-70	7-70	12-60
723	4	24	6-25	15	9	337	4400	27-8	21-6	27-8	30	3-87	8-20	13-00
714	3-5	23	6-40	16	9	349	4500	28-5	22-1	28-5	30	4-05	8-60	13-40
705	3-5	23	6-54	16	9	361	4600	29-1	22-6	29-1	31	4-20	9-10	13-80
695	3-5	22	6-69	17	10	373	4700	29-8	23-1	—	—	—	—	14-26
687	3	21	6-83	17	10	385	4800	—	—	—	—	—	—	14-72
679	3	21	6-98	18	10	397	4900	—	—	—	—	—	—	15-18
671	3	20	7-13	18	11	409	5000	—	—	—	—	—	—	15-64
663	3	20	7-27	19	11	421	5100	—	—	—	—	—	—	16-10
655	2-5	20	7-42	19	11	433	5200	—	—	—	—	—	—	16-55
647	2-5	19	7-56	20	12	445	5300	—	—	—	—	—	—	17-00
639	2-5	19	7-71	20	12	457	5400	—	—	—	—	—	—	17-45
631	2-5	19	7-85	21	13	469	5500	—	—	—	—	—	—	17-90
623	2-5	18	8-00	22	13	481	5600	—	—	—	—	—	—	18-35
615	2	18	8-14	22	13	493	5700	—	—	—	—	—	—	18-81
607	2	18	8-29	23	14	505	5800	—	—	—	—	—	—	19-26
599	2	17	8-43	24	14	517	5900	—	—	—	—	—	—	19-71
592	2	17	8-58	25	15	529	6000	—	—	—	—	—	—	20-16
585	2	17	8-73	26	15	541	6100	—	—	—	—	—	—	20-61

## DRILL.

The detachment consists of nine numbers, and falls in two deep (one pace between ranks) in rear of the gun, which is limbered up.

### *To Tell Off.*

Officer.  
Tell Off.

No. 1.

At "Tell off" No. 1, who is on the right of the detachment, takes a pace to his front, turns to his left, and numbers himself 1; the right-hand man of the rear rank numbers 2; the right-hand man of the front rank, 3; the second man from the right of the rear rank, 4; the man in his front, 5; and so on. After the detachment is told off No. 1 falls in again on the right of the front rank.

No. 3 then straps on the fuze key and tube pocket.

### POSITION OF DETACHMENT WHEN LIMBERED UP.

#### *In Order of March.*

No. 1 in line with the point of the near shaft and two yards on the left of it.

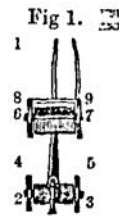
Nos. 2 and 3 in line with the axletree of the gun-carriage.

Nos. 4 and 5 in line with the centre of the trail.

Nos. 6 and 7 in line with the axletree of the limber.

Nos. 8 and 9 in line with the splinter-bar.

The Nos. stand covering, one yard from the wheels. (Fig. 1.)



#### *In Front.*

Two deep, two yards in front of the shafts or leaders' heads.

#### *In Rear.*

Two deep, two yards in rear of the muzzle of gun.

#### *Right or Left.*

Two deep, in line with the gun axletree one yard to the right or left of the wheel.

*Mounted.*

## (Battery of Field Artillery.)

No. 1 on his horse; 2 and 3 on the gun-limber; 4 and 5 on the axletree seats; 8 and 9 on the wagon-limber; 6 and 7 in front of the wagon body; 2, 4, 6, 8 on the near, 3, 5, 7, 9 on the off side.

When going into action 6 will ride between 2 and 3 on the gun-limber.

## (Battery of Horse Artillery.)

Nos. 2 and 3 on the gun-limber; 8 and 9 on the wagon limber; 2 and 8 on near; 3 and 9 on off boxes.

With detach- ments of 6	front rank..	4	12*	1	
	rear rank ..	11*	6	5	
With detach- ments of 7	front rank..	5	4	12*	1
	rear rank ..	11*	13*	6	
With detach- ments of 8	front rank..	5	4	12*	1
	rear rank ..	11*	6	13*	7

*To Mount.*

## (Battery of Field Artillery.)

<i>Officer.</i>	<i>No. 1:</i>
Prepare to mount	Prepare to mount.
Mount.	Mount.

"Prepare to mount."—No. 1 runs to his horse, the other Nos. double to their places at the carriages; 2 and 8 lay hold of the guard-irons with the left, 3 and 9 with the right hand, placing the inner foot on the trail or perch handle; 4 and 6 lay hold of the guard-iron with the right hand, placing the right foot on the foot-rest or spoke; 5 and 7 lay hold of the guard-iron with the left hand, placing the left foot on foot-rest or spoke. When 6 has to mount on the gun-limber, he lays hold of the left guard-iron with his right hand and places his right foot on the spoke of the wheel in front.

"Mount."—The whole spring into their places (the Nos. on the gun- and wagon-limbers facing to the rear, but turning round to the front, lifting their feet close together, and throwing them over the guard-irons, the numbers on the axletree seats turning outwards), and, when seated, lay hold of the hand-straps with both hands and sit upright.

At the word "March," the gunners on the boxes and axletree seats lay hold of the guard-irons with their outward hands and when passing over rough ground they should slightly raise themselves so as to avoid being jolted.

"Sit at ease."—Drop the hand-straps and sit well back, both hands remaining between the thighs.

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\* This mark denotes horse-holders.

*To Mount.*

(Battery of Horse Artillery.)

<u>Officer.</u>	<u>No. 1.</u>
Prepare to mount.	Prepare to mount.
Mount.	Mount.

"Prepare to mount."—Nos. 1, 4, 5, 6, and 7 run to their horses' heads by the front, 2, 3, 8, and 9 to the limbers; 2 and 8 lay hold of the guard-irons with the left hand, 3 and 9 with the right hand, placing the inner foot on the trail or perch.

"Mount."—The whole spring into their places, the numbers on the gun-limbers facing to the rear, but immediately afterwards turning round to the front, by lifting their feet close together, and throwing them over the guard-irons.

*To Dismount.*

(Battery of Field Artillery.)

<u>Officer.</u>	<u>No. 1.</u>
Prepare to dismount.	Prepare to dismount.
Dismount.	Dismount.

"Prepare to dismount."—Nos. 2, 3, 8, and 9, throwing their legs over the guard-irons, turn to the rear; Nos. 4 and 5 place their inward hands on the gun, and their feet in front of the foot-rests, the other Nos. stand up, keeping their outward hands on the guard-irons.

"Dismount."—The whole jump off and form the order of march, but if for action they go to their posts at the gun. When 6 has to dismount from the gun-limber, he jumps off on the near side.

*To Dismount.*

(Battery of Horse Artillery.)

<u>Officer.</u>	<u>No. 1.</u>
Prepare to dismount.	Prepare to dismount.
Dismount.	Dismount.

"Prepare to dismount."—Nos. 2, 3, 8, and 9, throwing their legs over the guard-irons, turn to the rear.

"Dismount."—The whole dismount and stand at attention.

If for action the horse-holders do not dismount, the other numbers take their posts at the gun, the dismounted Nos. leaving their horses by the rear; when the detachment is in rear of the gun, they leave their horses by the front.



(Horse and Field Batteries.)

## EXERCISE WITH DRAG-ROPES.

When drag-ropes are used, Nos. 2 and 3 hook them to the drag-washers on their own side. All available numbers man them on their own sides. The highest number is in the shafts.

## TO ADVANCE WITHOUT DRAG-ROPES.

Nos. 2 and 3, between muzzle and wheel, push at the axletree-seats, 4 and 5 man the gun-wheels, highest No. in the shafts, remaining Nos. assist.

## CHANGE OF POSITION OF DETACHMENTS.

*To form the Order of March from Detachment Front.*

<u>Officer.</u>	<u>No. 1.</u>
Form the order of march.	Right turn, double march.

"Right turn, double march."—No. 1 turns with the detachment, takes a side pace to his left, allows the detachment to pass him, then doubles to his post; 2 and 3 wheel to their right and open out. Each number halts when at his post; they turn to their front together, looking to No. 2, who turns about immediately he arrives at his station.

*To Form the Order of March from Detachment Rear, Right, or Left.*

<u>Officer.</u>	<u>No. 1.</u>
Form the order of march.	Left turn, double march.

When the detachments are in rear, or on the right, they proceed direct; but when on the left, they countermarch to the left. No. 1 heads the rear rank, changing his flank by the front. Each number halts when at his post.

*To Change from Front to Rear.*

<u>Officer.</u>	<u>No. 1.</u>
Detachment rear.	Left about wheel, double march Forward. Left about wheel, forward, halt.

When the detachment is two yards in rear of the muzzle, it halts.

*To Change from Rear to Front.*

<u>Officer.</u>	<u>No. 1.</u>
Detachment front.	Right incline, double march. Forward. Left incline, forward, halt.

When the detachment is clear of the gun it inclines to its left; when in line with the position of "Detachment front," "Forward, halt," is given.

*To Change from Rear to Right or Left.*

<u>Officer.</u>	<u>No. 1.</u>
Detachment right (left).	Right (or left) incline, double march.
	Forward, halt.

The detachment inclines to its front when one yard clear of the gunwheel, and halts when in line with the axletree.

*To form Detachment Rear from the Order of March.*

<u>Officer.</u>	<u>No. 1.</u>
Detachment rear.	Right about turn, double march.
	Halt, front.

Nos. 2 and 3 close to the centre, and wheel to their left, marking time when opposite the off wheel and two yards from it. As soon as the detachment has closed up, it is halted and turned to the front.

*To Form Detachment Front from the Order of March.*

<u>Officer.</u>	<u>No. 1.</u>
Detachment front.	Double march.
	Halt, front.

No. 1 doubles out two yards in front of the off shaft, turns to his left, and gives the order "Double march." Nos. 8 and 9, followed by the other Nos., double out. When 8 and 9 arrive in line with No. 1 they wheel to their left and mark time; when the detachment is closed up, No. 1 gives "Halt, front," turning himself to the front at the same time.

*To Change Rounds when the Gun is Limbered up.*

The detachment being at the "Order of March" in changing rounds:—

No. 2 becomes No. 4
" 4 " " 6
" 6 " " 8
" 8 " " 1
" 1 " " 9
" 9 " " 7
" 7 " " 5
" 5 " " 3
" 3 " " 2

*To Unlimber.*

<u>Officer.</u>	<u>No. 1.</u>
Action front.	Action front.
" (right).	" (right).
" (left).	" (left).
" (rear).	" (rear).

"Action, front."—No. 3 unkeys, and with No. 2 lifts the trail; when the trail is clear of the hook, No. 3 gives "Limber, drive on."  
(5973)

The trail is carried round a half-circle to the left by Nos. 2 and 3, No. 2 shifting round the trail-eye to avoid walking backwards; the wheels are manned by Nos. 4 and 5, the trail is lowered to the ground, and the Nos. take post as detailed.

The limber moves forward one yard and reverses to the right; when sufficiently to the rear it reverses to the right again, and halts ten yards in rear of the trail-eye, covering the gun. The wagon reverses to the right, and when sufficiently to the rear, reverses to the right again and halts four yards in rear of and covering the limber.

"Action, right," is the same as "Action, front," but the trail is carried round a quarter of a circle only; the limber drives on one yard, then takes ground to the left and reverses to the left. The wagon the same as the limber.

"Action left."—The trail is taken to the right; No. 3, in this case, shifting round the trail-eye. The limber moves forward one yard, then takes ground to the right and reverses to the right.

"Action rear."—The gun is unlimbered in the same manner, but the trail is not thrown round; the limber moves forward one yard, inclines to the left, and then reverses to the right, and halts ten yards from the trail-eye, covering the gun. The wagon inclines to the left, moves to the rear, and forms up four yards in rear of the limber.

In all unlimbering, except for "Action left" and "Action rear," No. 2 will shift round the trail, as soon as it is unhooked, to avoid walking backward.

When there are no horses Nos. 6, 7, 8, and 9 attend to the limber; No. 9 is between the shafts, 8 at the point of the near shaft, 7 at the point of the off shaft, and 6 in rear of the limber.

No. 1 is responsible for the correct dressing of his gun when it comes into action.

#### *To Limber-up.*

<u>Officer.</u>		<u>No. 1.</u>
Front limber-up.		Front limber-up.
(Right) "		(Right) "
(Left) "		(Left) "
(Rear) "		(Rear) "
		Halt, limber-up.

Limbering-up may be done to the front, right, left, or rear.

"Front limber-up."—The trail is lifted by 2 and 3 and carried round a half-circle to the right, and lowered gently to the ground. Nos. 4 and 5 man the wheels. As soon as the trail is round Nos. 2 and 3 get under cover between breech and wheels, No. 1 in front of No. 2, Nos. 4 and 5, between muzzle and wheels, 6 and 7 if present in front of 4 and 5, the whole with their backs to the axletree. The limber comes up on the right of the gun; when it is square No. 1 gives "Halt, limber-up," Nos. 2 and 3 lift the trail and place it on the hook, 4 and 5 man the wheels. No. 3 keys-up, and the whole form the order of march.

"Right limber-up."—The same as "Front limber-up," except that the trail is only carried round a quarter of a circle.

"Left limber-up."—The trail is carried round a quarter of a circle to the left, and the Nos. get under cover as before.

"Rear limber-up."—The numbers get under cover as before, but the limber reverses to the left as soon as it arrives at the trail, which is not thrown round.

The instructor can at any time ascertain that each number is at his post by proving. This he does by calling out, "No. 1, Prove," "No. 3, Prove," &c. The man called upon raises his right arm and extends it smartly to the front, hand open, thumb uppermost, hand as high as the shoulder. When the next No. is called he drops his hand. The last number lowers his hand at the word "Down."

On all occasions before giving a word of command, No. 1 should repeat the number of his gun.

#### POSITION AND GENERAL DUTIES.



No. 1 stands on the right of the trail-eye, ships and unships his handspike, commands, lays, sees that the time fuze has been set correctly by 3, and lifts at the end of handspike in running up or back.

When the selected layer is not the No. 1 of the sub-division, the latter will take post as No. 3, and perform the duties of that number with the addition of "Commands." The selected layer will take post as, and perform the duties of No. 1, except "Commands." After "Cease Firing," they will resume their proper places.

No. 2 stands close to and facing the breech on the right side, attends\* to the right brake, rams home, traverses, and mans the right wheel.

No. 3 stands close to and facing the breech on the left side, attends to the left† brake and vent, unlocks and locks the breech, supplies himself with ammunition from portable magazine, adjusts time fuzes, removes safety pins, loads, pricks cartridge, makes ready, fires, drifts vent, and mans the left wheel.

No. 4 stands 5 yards in rear of the left wheel, supplies No. 3 with ammunition in a portable magazine, or with single rounds, and mans the right wheel if necessary.

No. 5 stands in rear of the off limber-box, fuzes shell, loosens nuts of time-fuzes, supplies 4 with ammunition, in portable magazine, or with single rounds.

No. 6 stands in rear of the near limber box, assists 5, and mans the left wheel if required.

Nos. 7, 8, and 9 constitute the reserve, stand (or lie down) 5 yards in rear of the limber (or any adjacent cover). They replace casualties at the gun, take the place of men who are fatigued; and replenish the limber with ammunition from the wagon when required. (Fig. 2.) Should the distance or the nature of the ground between gun and limber render No. 4's duties very arduous, one of the reserve numbers should, if present, assist in supplying ammunition.

During the cessation of fire, the gun detachments should, whenever considered advisable, be ordered to lie down. When required to resume their places the word "Rise" should be given.

\* With Mark II carriage omit the words "attends to right brake."

† With Mark II carriage omit the word "left."

## GENERAL DUTIES WITH REDUCED NUMBERS.

## 5 Numbers.

No. 4 performs the duties of No. 6 in addition to his own.  
Remaining numbers as usual.

## 3 Numbers.

No. 1 performs No. 2's duties (except traversing), in addition to his own.

No. 2 performs the duties of Nos. 4 and 5, and traverses.  
No. 3 as usual.

<i>Officer.</i>	<i>Action.</i>	No. 1.
<i>Action.</i>		<i>Action.</i>

The gun being unlimbered and horizontal, tampeon removed, fuze and tube pockets filled and buckled on, sights fixed, Scott's sights, if used, made ready, and several points to lay on selected,—at the word—

"Action."—No. 1 ships the handspike, opens the breech, sees that the bore is clear, and that gun, sights, fittings, &c., are in good working order, and (if using Mark II carriage), that the brake is correct.

No. 2 puts the right brake in gear,\* and takes post close to and facing the breech.

No. 3 puts the left brake in gear,\* and takes post close to and facing the breech, takes the lanyard out of the tube pocket, coils it up and places it under his belt.

No. 4 takes post 5 yards in rear of the left wheel.

No. 5 and No. 6 prepare to issue ammunition.

A single gun is numbered "No. 1 Gun."

		<i>Load.</i>		
		<i>Officer.</i>		No. 1.
No. 1 Gun	Shell (a),	Right (d)—yards,		Shell (a),
	Shrapnel (b),	Deflection (e), or,		Shrapnel (b).
	fuze (c),	Left (d)—yards,		fuze (c),
	Case,	Deflection (e), or,		Case
	Blank cartridge	Front (d)—yards,		Blank cartridge.
		Deflection (e).		
	<i>Load.</i>			<i>Load.</i>

N.B.—(a) Common shell and percussion fuze always understood unless otherwise ordered.

(b) Time fuze always understood unless otherwise ordered.

(c) Here state number of divisions of fuze required.

(d) Here indicate target.

(e) Here order number of minutes deflection necessary.

If the elevation is to be given by the clinometer, or with Scott's sights, the command is "— degrees, instead of "— yards."

"Load."—No. 1 communicates to No. 5 the directions which he receives as to projectile, fuze, &c., sets his tangent scale to the required elevation and deflection, taking it out of the gun and replacing it when set, and at once proceeds to lay the gun; when time fuzes are used he sees that they have been set correctly by 3 by means of

\* Except with Mark II carriage.

a socket provided for the purpose (the nuts having been previously loosened at the limber), halting in the operation of laying to do so.

"No. 2 traverses as directed. While No. 1 is examining the fuze, he unships the handspike by withdrawing it from the socket, left hand back up, cants it over, unshod end next the gun, meeting it with the right hand back up, takes a pace to the front with the left foot, and, placing the unshod end of the handspike against the base of the projectile, rams it hard home. He then steps back, ships the handspike and stands ready to continue traversing, if necessary.

No. 3 unlocks the breech-screw, if closed, by raising the lever with his left hand to its full extent, draws it towards him as far as it will go, then folds the lever down, which practically extracts the breech-screw, and with his right hand throws the breech open by the loop. (At drill he withdraws the cartridge, replacing it in the portable magazine, or returning it to No. 4.) He receives a round from No. 4, placing cartridge under left arm, or supplies himself with a round from the portable magazine, sets the time fuze when used, and shows it to No. 1, withdraws, safety pins, and enters the projectile its own length into the bore. As soon as the shell is rammed home, he inserts the cartridge by hand as far as it will go. When the cartridge is entered, he closes the breech as follows:—He takes the lever in his left hand and raises it to its full extent, swings the carrier containing the breech-screw round till it is flush against the breech, pushes home the breech-screw with his right hand on the loop provided for the purpose, still keeping the lever raised with his left hand; when the screw is home he locks it by pushing the lever from him with his left hand as far as it will go, and then folding it down. He then pricks the cartridge and prepares a tube.

No. 4 doubles to the limber for a round of ammunition which he receives, shell in his right, cartridge in his left hand; he hands them to No. 3; he then returns for another round or for a portable magazine as may be ordered. If the former, he procures it from the limber and goes with it to his post. If the latter, he places it conveniently near No. 3, and then takes post. As a rule he will bring up a common shell for the first round, and then the portable magazine containing one common and two shrapnel, or as may be ordered. At drill, he recovers the drill shell as soon as the gun is run up, and either replaces it in portable magazine or returns it to the limber.

No. 5 issues ammunition and fills the portable magazine, he fuzes the shells and loosens the nuts of the time fuzes before placing them in portable magazine, or handing them to 4 as ordered. He should take care the limber box is open as short a time as possible. No. 6 assists him.

<i>Officer.</i>	<i>To Lay the Gun.</i>	<i>No. 1.</i>
		Trail (right).
		" (left).
		Halt.

When No. 1 has set his sights, he proceeds to lay the gun, ceasing to do so only to examine the fuze set by No. 3, and to allow the loading to be completed. As soon as No. 1 has satisfied himself that the breech is securely closed, he finishes the laying and removes the tangent sight and socket, or the telescopic sight, as the case may be.

No. 2 traverses with the handspike as directed, taking care to move the gun little or much according to the indication given by No. 1's right hand as in silent drill. While No. 1 is examining the fuze, he unships the handspike, and places himself in position for ramming home; after ramming home he at once reships the handspike and stands ready to traverse. No. 2 should frequently be exercised in traversing.

If no order to fire should be given, No. 1 gives "Take post," when the numbers take post as detailed for "Action."

*To Make Ready and Fire.*

<i>Officer.</i>	<i>No. 1.</i>
Fire No.—gun.	No.—Ready.
	No.—Fire.
	Run up.
	Halt.

N.B.—No gun is ever to be fired without an order from the sectional officer and the No. 1.

At "Fire No.—gun," No. 1 gives the number of his gun and "Ready," and steps clear of the wheel; No. 3 presses the tube into the vent with his right thumb\*; steps outside the wheel and stands facing to the front, holding the lanyard taut with the left hand, the left elbow being bent so that the hand is level with the vent, the forearm across the body.

No. 2 steps smartly, outside the wheel.

"No.—Fire."—No. 3 slews his body smartly to the left and thus fires the gun; he replaces the lanyard under his belt. At drill he takes out the drill tube.

In the event of a miss-fire, No. 3 will go round to the front of the axle-tree on his own side, and from there drop in another tube, keeping clear of the muzzle, resuming the position of "Ready."

As soon as the gun is fired, No. 1, if necessary, gives the order "Run up." Nos. 2 and 3 man the wheels, No. 1 lifts at the handspike; at "Halt" each number returns to his place, No. 3 drifts the vent, opens the breech, and (with Mark II carriage), releases the brake.

N.B.—While in action No. 1 will be careful to note that the lid of the trail box is securely closed and fastened by the turnbuckle, the jar of firing sometimes loosens the latter; he will also watch that all nuts are securely tightened; that the axle seats are not working loose; that the brakes are working efficiently; that the several parts of the breech action are in proper positions; and that the breech is securely closed by No. 3, and that the vent is tightly screwed up; it sometimes works loose after the first round or two. It should be removed and examined as ordered.†

\* The tube is never to be inserted in the vent before the breech is properly closed, under any pretext whatever.

† The removable vents of 12 pr. guns, owing to very rapid scoring, require to be changed after a certain number of rounds varying from about 70 to 140. They should be taken out and examined by holding them up to the light before commencing to fire and after every 25 rounds. If circumstances allow, at the conclusion of practice, if, on removing the vent, any doubt exists as to its fitness for further firing, it should be replaced by a new one, as it is dangerous to continue firing with one that is much eroded.

*To Unload.*

With service ammunition, if it is required to unload a round of case, No. 3 opens the breech, withdraws the cartridge and case, and replaces them in the magazine, or returns them to 4.

Common and shrapnel are not unloaded. Shell once loaded should be fired when practicable, but if this cannot be done the cartridge is to be withdrawn and the shell left. Experiments show that fuzeed shell may be travelled in the gun without exploding, but this is not to be done when it can be avoided, and then only by the Commanding Officer's order.

*To Cease Firing.*

<u>Officer.</u>		<u>No. 1.</u>
Cease firing.		Cease firing.

"Cease firing."—At this command, all guns fully loaded with shell are to be fired when the Commanding Officer orders, except as noted above; case shot or blank cartridge is to be unloaded as described in last paragraph.

No. 1 unships and secures the handspike, replaces the tangent scale, set at zero, and clamped.

No. 2 puts the right brake out of gear (except with Mark II carriage) and resumes his position.

No. 3 puts the left brake out of gear (except with Mark II carriage), the lanyard in the tube pocket, closes the breech, and resumes his position.

No. 4 returns the ammunition to the limber, and assists No. 5 to empty and secure the portable magazine.

No. 5 empties and secures the portable magazines; if shells have been prepared, he reinserts safety pins, removes the fuzes, screws in plugs, places shells, &c., in the boxes, and closes the latter.

"Stand fast."—If the firing is only to be stopped for a time, "Stand fast" should be given, on which all the Nos. stand fast (but should the tube be in the vent, it is to be removed). On the word "Go on," the service of the gun is continued, or on "Cease firing" the detachment proceeds as above.

*To Change Rounds in Action.*

<u>Officer.</u>		<u>No. 1.</u>
Change rounds.		Change rounds.

In changing rounds No. 1 becomes 9; 9, 8; 8, 7; 7, 6; 6, 5; 5, 4; 4, 3; 3, 2; 2, 1.

Should No. 1 be disabled No. 2 will take his place.

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## Drill by Signals.

Well-drilled detachments can be exercised with advantage by means of signals from the No. 1, thus enforcing silence, and compelling the Nos. to fix their attention on their own No. 1. The only commands necessary from the No. 1 are that of "—(shell) Load," and "No.—Fire."

### *To Load.*

"—Load."—No. 1 gives the order, and all Nos. proceed as with ordinary drill.

### *To Lay the Gun.*

"Trail right" or "Left."—No. 1 motions with the right hand in the required direction, the arm well back.

"Halt."—No. 1 drops the arm.

### *To Make Ready and Fire.*

"Ready."—No. 1 holds the left hand out in line with the shoulder.

"Fire."—No. 1 gives the order.

"Run up."—No. 1 runs to the trail.

"Halt."—No. 1 holds up the left hand.

### *To Unload.*

No. 1 holds up the right hand.

### *To Cease Firing.*

No. 1 unships the handspike.

## Dismounting and Mounting Ordnance.

### *To Dismount Gun and Carriage.*

*This is an exercise that should only be done in case of necessity, and every care must be taken that no part of the Gun or its fittings are injured.*

<u>Officer.</u>	<u>No. 1.</u>
Prepare to dismount gun and carriage.	Prepare to dismount the gun.
Dismount the gun.	Dismount the gun.
Dismount the carriage.	Dismount the carriage.
	Lift—Lower.

"Prepare to dismount the gun."—No. 1 removes the sights and elevating arc, places sights and small stores on a blanket clear of the gun, and mans handspike in the bore; Nos. 2 and 3 throw back the capsquares and inner stanchions of the guard-irons, and man the wheels on their own sides.

*With Mark II carriage, care must be taken, that the gun, when it has been disconnected at the breech, does not slide with the cradle to the front or rear.*

Nos. 4 and 5 remove side arms, &c., double two drag ropes, make fast the bights with a reef knot, half under and half over round the breech just in rear of the sight sockets, the running ends are then passed outside the tire of the wheels on the same level as the breech, two turns taken round the felloe, one on each side of a spoke (to prevent slipping), and made fast, with a half hitch black walling against the tire. They then man the wheels.

No. 6 ships the handspike in the trail and mans it; No. 7 brings up the drag ropes to 4 and 5; Nos. 7 and 8 man the wheels on their own side; No. 9 places a handspike in the bore, and mans it.

"Dismount the gun."—Nos. 1 and 9 lift the gun clear of the trunnion holes and keep it horizontal, while 2, 4, and 8, on the right, 3, 5, and 7, on the left, man the wheels forward until the gun is lowered to the ground; No. 6 raises the trail off the ground till the trunnions are clear; then, if necessary, mans the handspike in the bore.

Should it not be possible for any reason to dismount the gun according to the foregoing method, it may be done as above with the following exceptions:—

"Prepare to dismount the gun."—4 and 5 make fast the ends of two drag ropes to the breech by a reef knot, half over and half under, pass the ends to the front, the ropes are manned by 1 and 8 on the right, 7 and 9 on the left, 6 stands at trail, eye ready to lift.

7 and 9 dig a hole (if necessary) for the muzzle about 12 inches deep, and place a corn sack over the muzzle.

"Dismount the gun."—No. 6 raises the trail until the muzzle touches the ground; 2 and 3 man the wheels forward; 4 and 5 stand in rear of the axle on their own sides and prevent the capsquares falling back; 1, 8, 7, and 9 haul the gun out of the trunnion holes, steadying it when perpendicular.

"Lower the trail."—The trail is lowered and at "Run back" the carriage is run back by 2, 3, 4, 5, and 6.

"Lower the gun."—The gun is lowered gently by all the Nos. on their own sides walking forward with the drag ropes; they then take post, No. 1 facing the breech, and 2 and 3 being nearest to the muzzle. A handspike is placed for the breech to rest on, to save the elevating loop.

"Dismount the carriage. Lift."—2 and 3 in front, and 4 and 5 in rear lift the carriage, 6 and 7 in front, 8 and 9 in rear, take off the wheels, and at "Lower" the carriage is lowered to the ground, No. 1 assisting if necessary. Nos. 8 and 9 attend to the linchpins and washers.

The limbers and wagons are dismounted in a similar way, the boxes and shafts having been previously removed.

Wheels should be placed on the ground "dish down."

*To mount Gun and Carriage.*

<u>Officer.</u>	<u>No. 1.</u>
Mount gun and carriage.	Mount the carriage.
	Lift.
	Prepare to mount the gun.

The operation of mounting a carriage and gun is the converse of the above.

With the first method it makes lighter work if wheel purchases are applied. The capsquares are lowered until the trunnions arrive within a horizontal distance of about 6 inches; 2 and 3 then raise them so that the breech coil can drop in rear without jamming. With the alternative method it is also the converse, except that 2 and 3 pass a drag rope under the muzzle and lift; 4 places a rammer under the gun just in front of the trunnions; the muzzle is borne down, drag ropes are attached as in dismounting, a handspike is placed; 2, 3, 4, and 5 lift at the handspike, and 1 at the breech; 6, 7, 8, and 9 haul on the drag ropes placed on the breech by 4 and 5, turns being taken round the handspike, the running ends, coming off below, and when the gun is perpendicular 1, 7, 8, and 9 steady it.

### Disabled Ordnance.

*Note.*—Wherever operations are not described in detail, or numbers are not told off to specific duties, the officer or non-commissioned officer in charge will fall in his detachment two deep, tell it off, and assign duties to the several numbers as may be required.

Operations can thus be carried out expeditiously and systematically without confusion, though no precise detail has been laid down.

#### *To Replace a Damaged Wheel.*

<u>Officer.</u>	<u>No. 1.</u>
Right gun wheel disabled.	Right gun wheel disabled.
Left " " "	Left. " " "
	Lift.
	Lower.

When a gun wheel is disabled in action, the wheel from the limber or a spare wheel may be substituted for it, and the disabled wheel, if quite unserviceable, can be replaced as soon as another can be brought up. If the wheel be not quite unserviceable, should it be necessary to remove the carriage a short distance, it may be locked with a drag chain, the sound part on the ground, or should there be no shoe the wheel can be lashed to the trail.

"By a spare wheel."—6, 7, 8, and 9 lift the spare wheel off the perch; 7 brings it up; 2, 3, 4, and 5 backs towards the gun, lift the axles by a handspike (or shaft) applied underneath; 8 and 9 lay hold of the top of the opposite wheel, and by hauling on it assist the Nos. at the handspike; 7 steadies the new wheel; 1 and 6 lift off the old; 6 removes it; 1 and 7 put on the new; 1 gives "Lower," the handspike (or shaft), washer and linchpin are replaced; 6, 7, 8, and 9 put the disabled wheel on the perch, and the Nos. take post.

"By a limber or wagon wheel."—The horses are taken out; 2, 3, 4, and 5 assist in lifting the limber; 6 and 7 take off the wheel, and the axletree is lowered gently to the ground.

Wagon wheels are removed in the same manner as the gun wheels.

*To Shift Shafts from Single to Double Draught.*

<u>Officer.</u>	<u>No. 1.</u>
Shift the shafts from double to single draught.	Shift the shafts from double to single draught.

This is done by 7, 8, and 9 (or the three highest Nos.); 8 fetches the hammer, and with 7 shifts the shafts (the near one first), 9 holding up the shafts.

*To Shift the Shafts from Single to Double Draught.*

As above, the off shaft being shifted first.

*To put on the Drag Shoe.*

On a gunwheel 2 or 3 unhook the shoe, and throw it away from the wheel.

A wagon wheel is locked in a similar manner by 8 and 9.

To unlock the wheels Nos. 2, 3, or 9 with a hammer knock down the top keepers, the chain runs out, and the wheel passes over the shoe. The shoe is picked up by 2, 3, or 9, and hung by the ring on the hook on the breast of the carriage or rear of the wagon.

*To Remove the Gun and Carriage by a Limber.*

The gun is dismantled, the horses taken out; the limber is run over the gun so that the breech is towards the shafts, and the trunnions under the limber hook; the muzzle and the shafts are raised, and the gun slung with a drag rope round the trunnions to the limber hook; the end is passed to the front, and the muzzle borne down, a half hitch taken round the breech and made fast to the centre futchell.

The carriage is dismantled and turned over by all the Nos. with the trail towards the shafts. It is then lifted, trail first, up the front of the limber on to the top of the boxes, until the weight is balanced for draught.

The trail is secured by a drag chain to a handspike in the bore, the side arms are strapped to the trail, the wheels are placed, dish down, on the top of the carriage, securely lashed with drag ropes to the box handles in rear, and to the splinter-bar in front.

*To Remove a Gun and Carriage by a Wagon.*

The gun is slung to a limber as before. The carriage is turned over and the trail rested on the rear footboard of the wagon. It is then lifted by all the Nos. on to the wagon body until the trail-eye nearly touches the limber boxes (a piece of wood being placed underneath the bracket to protect the boxes), it is secured to the perch by the drag chain. The wheels are placed, dish down, on the top of the carriage, and lashed to the box handles.

## THE HASTY DISABLEMENT OF FIELD GUNS.

The hasty disablement of field guns will be carried out by the Royal Horse Artillery.

### Stores Required.

The following stores will be carried by each battery of Royal Horse Artillery:—

Boxes	..	{ guncotton slabs, 2— $\frac{1}{2}$ slab*	..	..	..	..	..	12
		{ stores, disabling ordnance, R.H.A.	..	..	..	..	..	1
		{ vesuvian matches	..	..	..	..	..	1
Cases	..	{ detonator, for 4†	..	..	..	..	..	3
		{ guncotton slabs†	..	..	..	..	..	6
Cylinders..		{ detonator, No. 8, for 4	..	..	..	..	..	3
		{ guncotton, primer, dry, 1 $\frac{1}{4}$ in. $\times$ 1 $\frac{1}{4}$ in., for 4	..	..	..	..	..	3
Detonators, No. 8	..	..	..	..	..	..	..	12
Guncotton	{	dry, primers, 1 perforation, 1 $\frac{1}{4}$ in. $\times$ 1 $\frac{1}{4}$ in...	..	..	..	..	..	12
		wet, slabs, 2 perforations, 6 $\frac{1}{2}$ in. $\times$ 6 $\frac{1}{2}$ in. $\times$ 1 $\frac{1}{2}$ in.‡	..	..	..	..	..	6
Matches, Vesuvian	..	..	..	..	..	..	..	20
Pouches, match-box†..	..	..	..	..	..	..	..	3
Rectifiers, guncotton primers	..	..	..	..	..	..	..	3
Twine, choking, 3-thread	..	..	..	..	..	..	.. pieces	3

These stores will only be issued in time of war. The guncotton and detonators will be carried by the Ammunition Reserve Column till active operations are impending; and, when required in the field, the supply of guncotton (both slabs and primers) will be replenished from the Royal Engineer Field Park.

The stores will be carried in the "Box, stores, disabling ordnance, Royal Horse Artillery," until required for use, when they will be carried by horse-holders of Nos. 1, 3, and 5 subdivisions, one set in each subdivision, as follows:—

The leather cases for guncotton slabs—one on front of each wallet, fastened by a strap going round the wallets, passing through the staple, and then through two loops attached the ends of the guncotton cases.

The leather case containing the detonators and primers—under the picket-peg, in rear of the valise.

The leather pouch for vesuvian matches, and twist of twine—on the waist-belt.

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\* Copper tinned.      † Leather.      ‡ In half slabs, 1 perforation in each.

### Instructions for Carrying out the Operations.\*

Insert a detonator into a dry primer.

*On no account should a detonator be twisted or roughly forced into a primer.*

Insert the dry primer fitted with detonator into the perforation in the slab, pushing it gently in until the hole in the slab is quite filled by it.

Tie a piece of twine round the detonator, pass the ends round the slab, and then tie them together; the object being to prevent the primer slipping out of the slab.

Place the slab lengthways on the chase, its long side touching about a foot from the muzzle. Tie it on tightly with twine to prevent it slipping from wind or other disturbing cause.

The exact position must depend upon the form of the gun. The great thing is to have as much of the surface of the cotton in actual contact with the gun as possible. Hence the slabs should not ride on an astragal or moulding, but should always be placed on a plain part of the chase.

Observe the direction of the wind, and arrange so that the tail of the safety fuze is away from the slab and to leeward of it. This is to lessen the chance of a spark igniting the guncotton before the detonator is fired, in which case, in all probability, no effect whatever would be produced on the gun.

If projectiles belonging to the gun are available, and time allows, it is advisable to ram one up the bore; so that when the gun is dented by the explosion it may be imprisoned there and prevent the gun from being used even to fire a bag of bullets.

Tear or cut the little calico cap off the end of the safety fuze and ignite the fuze by the vesuvian matches provided, or other convenient means. An ordinary flame does not readily ignite it. The fuze ignites most easily when cut obliquely with a sharp knife.

Retire under cover, and await the explosion. The length of safety fuze will burn about 45 seconds.

Should circumstances permit, the effect of the detonation will be increased by placing a filled sand bag or a sod of turf on the guncotton, when lashed in position on the chase. Great care should be taken in this operation not to strike or bend the detonator.

It is also advisable, after the explosion, to try if the gun is so dented as to prevent loading. If the dent is not sufficient, the operation should be repeated, putting the fresh slabs in the same place as the first.

#### *Caution.*

Never roughly bend or kink the safety fuze. If it has apparently gone out without firing the detonator, allow at least half an hour to elapse before meddling with it, if time will admit, but if not, the greatest care must be taken in touching it, to avoid accident by a "hang-fire."

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\* See note at end.

The above instructions apply equally to the hasty disablement of guns of 64-pr. and larger calibres, but with them two slabs of guncotton must be used.

NOTE.—The above instructions have been prepared with special reference to the disablement or destruction of muzzle-loading guns. Breech-loading guns can generally be temporarily disabled by the removal or destruction of portions of the breech apparatus. In destroying such guns, or rendering them permanently disabled, Officers will, while being guided generally by these instructions, use their discretion as to the application of the charges in such positions as may appear most suitable, according to the particular construction of the gun to be operated upon.

#### INSTRUCTIONS FOR USING WATKIN'S CLINOMETER.

*To read the angle marked on the drum.*—The brass drum is marked in degrees, commencing at  $0^{\circ}$  on the top to  $45^{\circ}$  at the bottom. Each degree is sub-divided into 12 parts, each small division, therefore, represents angles of 5 minutes.

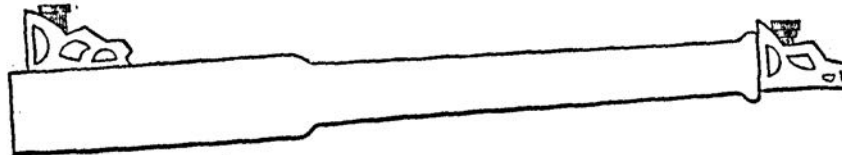
The scale is read from right to left, thus—



the reading opposite the arrow would indicate an angle of  $2^{\circ} 25'$ .

*To lay a gun for elevation.*—Unscrew the drum until  $\Psi$  points to the elevation required, place the clinometer on the planed portion of the breech, or against the muzzle, thus—

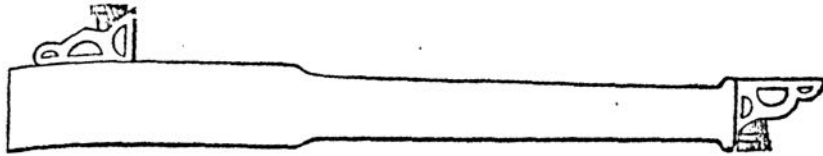
FIG. I.



and elevate the piece until the bubble of the spirit-level is in the centre of the tube.

*For angles of depression.*—Proceed as above, but reverse the direction of the instrument, thus—

FIG. II.





LIST OF STORES carried on the Carriage and Limber for  
12-pr. B.L. Gun, Mark I and II Equipments.

Name of Store.	Number of each.	Where carried.
<b>CAMP EQUIPMENT.</b>		
Buckets, water, G.S. leather ..	4*	On breast chain rings.
Kettles, camp, oval, 12 quarts ..	1	In front of axletree of limber, near side.
Strap, securing lid camp kettle ..	1	On lid.
<b>HARNES AND SADDLERY.</b>		
Couples, trace .. .. .	2	On lid, off limber box.
<b>TOOLS, ARTIFICERS' AND LABOURERS.</b>		
Axes, felling, curved helve ..	1	Under footboard.
Pick, 6½ lb. helved. ..	1	Under axletree, limber.
Drivers, screw, G.S. 4-inch ..	1	On lid, off limber box.
Hammers, claw, 20 oz. ..	1	On off bracket of carriage.
Hooks, bill .. .. .	1	Under limber, off side.
Pincers, carpenters .. .. pairs	1	{ In leather box on trail <sup>1</sup> . On near bracket <sup>2</sup> .
Spades, N.P. .. .. .	2	On outer sides of limber boxes.
Spanners, McMahon, 15 inch ..	1	{ In leather box on trail <sup>1</sup> . On off bracket <sup>2</sup> .
<b>MISCELLANEOUS STORES.</b>		
Brushes, water, carriage .. ..	1	Under limber, near side.
Cloths, sponge, cotton .. ..	4	In near limber box.
Composition, anti-corrosive .. oz.	3	As convenient.
Grease .. .. . lb.	3	In grease box.
Oil, Rangoon .. .. . pint	1	In oil can.†
<b>ORDNANCE.</b>		
Boxes { tool, carriage field, B.L., 12-pr. .. .. .	1	On trail of carriage <sup>1</sup> .
grease, 3 lb. .. ..	1	Rear of axletree, limber.
obturator pads .. ..	2	On lid of near limber box.
Brushes, breech screw .. ..	1	{ In leather box on trail <sup>1</sup> . On off bracket <sup>2</sup> .
Cans, lubricating, No. 3 .. ..	1	Rear of axletree, limber.
Caps, lifting, case shot .. ..	4	On case shot.
Caps, sponge, No. 6 .. ..	2	On cleaners.
Carriage, field, B.L. .. ..	1	

\* Two only with R.H.A., except No. 1 Subdivision on Peace Establishment.

† Additional oil is provided and carried in the R.A. wagon.

<sup>1</sup> For Mark I Equipment.

<sup>2</sup> For Mark II Equipment.

## LIST OF STORES—continued.

Name of Store.	Number of each.	Where carried.
<i>Fittings (spare).</i>		
Bolt, brake band (with nut) ..	1	On lid of near limber box. <sup>1</sup>
<i>Special implements.</i>		
Key, brake band ..	1	In leather box on trail. <sup>1</sup>
Spanners, gear elevating* ..	1	In leather box on trail. <sup>1</sup>
Spanners, tensile stay ..	1	On near bracket. <sup>1</sup>
Cartouches, B.L., 12-pr. { carriage	1	In trail box. <sup>1</sup>
limber..	2	1 in each limber box.
Cleaners { piasaba ..	1	On off
wool ..	1	On near } tensile stay.
Clinometers ..	1	On lid of off limber box.
Cover breech, B.L., 12-pr. ..	1	On breech of gun when travelling, between brackets of carriage, under gun when in action.
Handspikes { common 6 ft. ..	1	On splinter bar of Nos. 2, 4, and 6 limbers.
traversing, field, B.L., 12-pr. ..	1	1 on each trail and 1 spare on splinter bar of Nos. 1, 3, and 5 limbers.
Keys, spring lock ..	2	On handles of limber boxes.
Lanyards, friction tube, field ..	3	2 on lid of near limber box.
Limber, field, B.L., 12-pr., carriage	1	1 in pocket tube special.
Magazines, portable, B.L., 12-pr. ..	2	In rear of limber.
Ordnance, B.L., 12-pr., with sights and clamps, complete ..	1	2 sights, fore, on lid of off box.
		1 tangent sight and clamp, on each box lid.
<i>Fittings (spare).</i>		
Bolts, vent† ..	3	On lid of near limber box.
Discs, pad adjusting ..	2	
obturator { protecting sets	2	In boxes.
Pads, obturating ..	2	
Pins, keep, bolt, elevating ..	1	On lid of near limber box.
Keys, split, of sizes ..	9	Under case shot in. <sup>2</sup>
Springs, clip, carrier ring ..	3	Near gun limber box.
Washers, vent bolt, copper ..	3	On lid of off limber box.
		" " " " "
<i>Special implements.</i>		
Prickers, bolt, vent ..	2	On transom of carriage.
Wrench " " ..	1	In leather box on trail. <sup>1</sup>
Pins, linch, 2nd class, steel ..	1	On top of trail. <sup>2</sup>
Pockets, tube, L.S. ..	1	On lid of off limber box.
" fuze key ..	1	In leather box on trail. <sup>1</sup>
Ropes, drag, light, pairs ..	1	On off bracket. <sup>2</sup>
Shot, B.L. case ..	4	On left tensile stay.
		On platform board of limber.
		2 in each limber box.†

\* The spanner for Mark II Equipment fits the hydraulic buffer gland also.

† Complete with 1 split steel washer, 1 copper washer, and 1 nut.

‡ Two from the wagon are carried in trail box when going into action, with Mark I carriage.

<sup>1</sup> Mark I Equipment only.  
(5973)

<sup>2</sup> Mark II Equipment only.

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## LIST OF STORES—continued.

Name of Store.	Number of each.	Where carried.
Sight (Scott's) telescopic .. .	1	In steel box on platform board of limber, near side.
Spikes, gun, common.. ..	2	In leather box on trail. <sup>1</sup>
Straps, tube box .. ..	1	As convenient.
Tampons, B.L. 12-pr. .. ..	1	In pocket.
Vent servers .. ..	1	On breast hook of carriage, in action.
Washers, drag, 2nd class, C (spare)	1	Attached to breech cover.
		Under platform board, limber.
MAGAZINE STORES.		
Cartridges { drill .. ..	1	In trail box. <sup>1</sup>
{ B.L., filled, 4 lb. S.P.	36	As convenient. <sup>2</sup>
Covers, cartridge, canvas .. ..	36	18 in each cartouche.*
{ percussion, small, No. 8 ..	12	On cartridges.
Fuzes { time and percussion, short,		
{ No. 55 .. ..	24	In fuze boxes.
{ time and percussion, middle,		
{ No. 54 .. ..	14	7 in each limber box.
Keys, fuze, universal .. ..	2	1 on lid near limber box, and 1 in pocket on left tensile stay.
Shell { drill .. ..	1	In trail box. <sup>1</sup>
{ B.L. filled { common ..	8	As convenient. <sup>2</sup>
{ (with plugs) { shrapnel ..	24	In limber boxes.
Tubes, friction, copper, L.S. short ..	75	In near limber box.

\* Two from the wagon are carried in trail box when going into action, with Mark I carriage.

<sup>1</sup> Mark I Equipment.

<sup>2</sup> Mark II Equipment.

## LIST OF STORES CARRIED IN EACH

## 12-PR. B.L. AMMUNITION WAGON AND LIMBER.

Articles.	Number of each.	Where carried.
CAMP EQUIPMENT.		
Kettles, camp, oval, 12 quarts ..	3	1 front of axletree, limber, near
Straps, securing, lid kettle, camp ..	3	side; 2 front of axletree, body.
HARNESS AND SADDLERY.		
Couples, trace .. .. .	2	On lid off limber box.
TOOLS, ARTIFICERS' AND LABOURERS'.		
Axes { felling, curved helve.. ..	1	Under footboard, limber.
pick, 6½ lb., helved .. ..	1	Under axletree, limber.
Cases, saw, hand .. .. .	1	Under body.
Hooks, bill .. .. .	1	Under limber, off side.
Knives, clasp .. .. .	1	On lid, near body-box.
Needles, magazine, nickel silver, 4-inch .. .. .	2	In holdall.
Saws, hand, 26-inch .. ..	1	In leather case.
Scissors, Magazine .. .. pairs	1	On lid near body-box.
Spades, N.P. .. .. .	2	On outer sides, limber boxes.
Hooks, reaping .. .. .	2	" " body boxes.
MISCELLANEOUS STORES.		
Brushes, water carriage .. ..	1	Under platform-board, limber, near side.
Cloths, sponge, cotton .. ..	4	In near limber box.
Grease.. .. . lb.	31	In boxes.
Lines, Hambro .. .. .	1	In off body-box.
Marline .. .. . skeins	1	In near body-box.
Oil, Rangoon.. .. . pints	1	In oil can.
Silk { raw .. .. . oz.	2	} In holdall.
twist .. .. . oz.	2	
ORDNANCE.		
Can, lubricating, No. 3 .. ..	1	Rear of axletree, off limber.
Caps, lifting, case shot .. ..	4	On case shot.
Caps, sponge, No. 4 .. ..	*	On jointed sponge.
Carriages, field, B.L.		
Fittings (spare).		
Bolt, brake band, with nut ..	1	On lid of near limber box. <sup>1</sup>
Case, leather, tube pocket ..	1	On near stay of wagon body.

\* 1 Per battery.

<sup>1</sup> Mark I Equipment.

## LIST OF STORES—continued.

Articles.	Number of each.	Where carried.
Cartouches, B.L. 12-pr. wagon ..	4	1 in each ammunition box.
Clamp, tangent sight, B.L. 12-pr. (spare) .. .. .	1	1 on lid of near limber box of 2, 4, and 6 subdivisions.
Handspikes { common, 6 feet ..	1 }	On splinter { 1, 3, and 5 } wagons.
{ traversing, field ..	1 }	
Holdalls { spare parts ..	1	In near body-box.
{ needles and sill twist ..	1 }	On { lid off body-box. platform board. handles of boxes. lid near limber box.
Jacks, lifting, G.S. .. .. .	1 }	
Keys, spring lock .. .. .	4 }	
Lanyards, friction-tube, field ..	1 }	
Limbers, field, B.L. 12-pr. wagon ..		
<i>Fittings (spare).</i>		
Bolts { elevating (with keep pin) ..	1	} In holdall near body-box.
{ stop .. .. .	*	
Clips, head axial .. .. .	3	
Lever, cam (with hinge bolt and keep pin) .. .. .	1	In holdhall near body-box, 1, 3, and 5 subdivisions.
Pins, { elevating .. .. .	1	On lid near limber box.
keep { hinge { lever, cam ..	2	} In holdhall near body-box.
bolt       { ring, carrier ..	2	
Springs { clip, carrier ring ..	3	On lid of off limber box.
{ stud { catch { left ..	6	} In holdall, near body-box.
{ right ..	6	
{ retaining fore-sights ..	12	
Mauls .. .. .	1	Under wagon body.
Pins, linch, 2nd class, steel ..	1	On lid of off limber box.
Pockets, tube, L.S. .. .. .	1	In leather case on near stay of wagon body.
Posts, picket, 2½ feet .. .. .	6	Under wagon body.
Ropes, drag, light .. .. . pairs	1	On platform board.
Shafts, spare { No. 1, near ..	1	} Under { 1 and 5 } wagons.
{ „ 19, off ..	1	
Shoes, drag, No. 3 .. .. .	1	On perch.
Shot, B.L. case .. .. .	4	2 in each ammunition box of limber.
{ (Scott's) telescopic, with level .. .. .	*	In steel box, on platform board of limber, near side.
(spare) fore .. .. .	1	1 on lid of off limber box of 1, 3, and 5 subdivisions.
Sights { tangent .. .. .	1	1 on lid of near limber box of 2, 4, and 6 subdivisions.
{ wires, foresight .. yds.	1	1 in holdhall near body-box of 1 subdivision.
Sponges, R.M.L. 13-pr., jointed ..	†	On platform board.
Sticks, portfire .. .. .	1	On lid near body-box.
Straps, tube box .. .. .	1	In pocket.
Wagons, ammunition, B.L. 12-pr. ..	1	
Washers, drag, 2nd Class C (spare) ..	1	Under platform board, limber.
Wheels, 2nd class C, No. 36. ..	1	On perch arm. <sup>1</sup>
"       "       " 42. ..	1	"       "       " <sup>2</sup>

\* 1 per battery with No. 1 subdivision.

† 1 per battery strapped on platform board No. 6 wagon by attachment straps of ammunition boxes.

<sup>1</sup> Mark I Equipment.<sup>2</sup> Mark II Equipment.

## LIST OF STORES—continued.

Articles.	Number of each.	Where carried.
<b>MAGAZINE STORES.</b>		
Cartridges, B.L., filled, 4 lb. S.P. ..	72	18 in each cartouche.
" " " " 10 oz. R.L.G. <sup>2</sup>	2	1 in each cartouche of body-boxes.
Key, case, powder, metal lined ..	1	On lid off body-box.
Covers, cartridge { Canvas ..	72	1 on each cartridge.
{ Paper .. 10 oz.	2	1 on each 10 oz. cartridge.
{ percussion, small, No. 8 ..	24	} In fuze boxes.
{ time and percussion, short, No. 55.	48	
Fuzes* { time, sensitive, middle, No. 24. .. ..	2	1 in each body-box.
{ time and percussion, middle, No. 54 .. ..	14	} 1 in each limber box, under shrapnel shell.
{ drifts, G.S. .. ..	1	
{ funnels, shell, leather, common	1	} On lid off body-box.
{ keys, fuze, universal .. ..	1	
{ Match, slow .. .. lb.	1	In off body-box.
{ Portfires, common .. ..	4	2 on each lid of body-boxes.
{ Shell, B.L., filled (with common plugs) .. ..	12	} In boxes of wagon and limber.
{ .. .. shrapnel	56	
{ .. .. star ..	2	1 in each body-box.
Tubes { copper, L.S., short .. ..	75	In near limber box.
{ drill .. ..	1	To be carried as convenient.

## LIST OF STORES carried in the A. &amp; S. Wagon, in addition to the Equipment of the Wagon.

Leather cartouches.  
 Pairs short traces.  
 Pairs spare hames.  
 Pairs traces for breast harness R.H.A.  
 Corn sacks.  
 Picket posts.  
 Kicking straps.  
 Picketing ropes.  
 Reaping hooks with covers.  
 Mauls.

The number of each store, in the above list, which is actually carried, is not given, as it will vary according to the establishment on which the battery is held.

\* The following fuzes are issued for instructional purposes unfilled :—

Fuzes	{ sections	time and percussion, short, No. 55 ..	6	} 1 before firing and 1 after firing of each.
		percussion, small, I* .. ..	6	
		percussion, small, No. 8 .. ..	2	
		time and percussion, short, No. 55 ..	2	
		time, sensitive, middle, No. 24 .. ..	1	
		dummy, time and percussion, short, No. 55 ..	1	

1 Hook, G.S., wads, and 1 scraper, shell, field service, are issued and carried where convenient.

# MATERIALS, REPAIRING CARRIAGES, &C.

	War — Three Months Supply.	For use in Peace. — Twelve Months Supply.	For what Purpose.	Where carried.
<i>Vocabulary Section III.</i>				
Forges, field { Handles, lever, Mark IV, special* { cheesehead, $\frac{7}{8}$ in. $\times$ $\frac{1}{4}$ in.* (set of 8) { screws { hexagon head, $\frac{1}{4}$ in. $\times$ $\frac{7}{8}$ in.* (set of 9)	1 1 1	— — —	.. .. .. Field forge.. .. ..	Forge limber. No 3 drawer, wheelers tool chest.
<i>Vocabulary Section IV.</i>				
Borax, refined .. .. ..	$\frac{1}{4}$	—	Brazing .. .. ..	No. 2 drawer, smiths tool chest.
Chain, iron, $1\frac{1}{4}$ lb. per yard .. ..	$1\frac{1}{4}$	—	Tailboards .. .. ..	Forge limber.
Copper, hoop .. .. ..	30	—	General repairs to woodwork .. ..	Store wagon body.
Glue, best town made .. .. ..	1	$\frac{1}{2}$	Points of shafts .. .. ..	Forge limber.
Iron, wrought, hoop, $1\frac{1}{4}$ in., 14 W.G. .. ..	$1\frac{1}{2}$	1 $\frac{1}{2}$	.. .. ..	Store wagon body.
Locks, pad, iron, middling (spare)† .. ..	4	—	.. .. ..	1 forge limber, 1 store limber, and 2 store wagon body.
Nails { copper, { rose head, strong, No. 431† { wrought { facks, No. 473† { brad, wrought, No. 26 .. .. { clasp { fine { No. 71 .. .. { steel { wrought { strong, No. 80 .. ..	3	—	.. .. ..	No. 3 drawer, wheelers tool chest.
	2	—	Wheels, filling-in pieces, and repairs .. .. ..	
	1	$\frac{1}{2}$	General repairs .. .. ..	
	2	$\frac{1}{2}$	.. .. ..	
	3	$\frac{1}{2}$	.. .. ..	

Material	Quantity	Weight	Measure	Notes
clout, wrought, countersink	No. 103			
head, strong	No. 104			
tacks, Flemish black	No. 102			
Resin, black				
Salummeniac, in lumps				
brass				
1 1/4-inch, gauge No. 13				
" " No. 12				
" " No. 9				
3-inch, gauge No. 16				
2 " No. 14				
1 1/4 " No. 13				
" " No. 12				
" " No. 16				
" " No. 10				
" " No. 13				
iron				
flat head				
round head, 1 1/8 in. x 1/2 in.				
Solder, tinmans				
Spelter, brass				
Turpentine, spirits of				
Wire, copper, 15 W.G., soft				
Ares, elevating, carriage, field, B.L. 12-pr.†				
Bars, radius, brake, B.L. 12-pr.†				
Blocks, brake, B.L. 12-pr.†				
Boards, ammunition wagon, front, B.L. 12-pr.				
platform timber, B.L. 12-pr.†				
capsquare, B.L. 12-pr.†				
Bolts with nuts				
boss head V				
1/4 in. x 4 1/2 in.†				
1/4 in. x 3 1/2 in.†				

\* Not required when forge, field, Mark V, is issued.

+ For Mark I carriage only.

† For Mark II carriage only.



MATERIALS. REPAIRING CARRIAGES, &c.—continued.

War.	For use in Peace.	For what Purpose.	Where carried.
3	2	Foot boards	No. 3 drawer, wheelers tool chest.
2	2	Platform boards and seats	
2	1	Elevating bearings	
2	1	Plates, box, axle tree	
2	2	Elevating bearings..	
2	2		
2	2		
2	2		
3	1		
2	1		
1	1		Store wagon body.
1	1		
1	1		
1	1		
2	2		Store wagon limber.
2	2		
2	2		
2	2		

Iron, pieces	bolt { 1 ft. 7 in. x 1 in. . .	..	..	1	General repairs ..	..	Store wagon body.
	flat, 2 ft. 4 in. x 2 in. x 1 in. . .	..	..	1	Ring tires ..	..	..
limber hook, No. 2	tire, 12 in. x 2 1/2 in. x 1 in. . .	..	..	2	..	..	..
	split, guard-iron, B.L. 12-pr.†	..	..	6	Guard metal, elevating gear	..	Store wagon limber.
Keys	loop { 1-in. { x 3 in. . .	..	..	1	Bearing worm spindle, guard	..	..
	split, round { 1-in. { x 2 1/2 in. . .	..	..	4	irons, &c. . .	..	..
Leathers	spring lock { 1 1/2-in. { x 1 1/2 in. . .	..	..	2	Spindle, pinion, elevating..	..	..
	block, brake, B.L. 12 pr.†	..	..	4	Standard guard iron, and lever	..	..
Loops	hand ..	..	..	2	brake. . .	..	..
	levers, hand, releasing brake, B.L. 12-pr.†	..	..	4	Box spring, tensile stay ..	..	..
Loops	locks, spring, box, ammunition, B.L. 12-pr.	..	..	2	Bracket securing seat, inner	..	..
	draught limber, field, { double	..	..	6	Seat guard irons ..	..	Forge wagon or store wagon as
Loops	B.L. 12 pr. { single..	..	..	6	Field forge, &c. . .	..	convenient.
	handspike ..	..	..	4	Bracket securing seat, inner and	..	..
Leathers	spring lock { 1 1/2-in. { x 1 1/2 in. . .	..	..	8	outer. . .	..	..
	block, brake, B.L. 12 pr.†	..	..	2	Bolts, axletree clip plates..	..	..
Loops	hand ..	..	..	2	Pins, joint, capsquare ..	..	..
	levers, hand, releasing brake, B.L. 12-pr.†	..	..	2	Spring, pawl, brake ..	..	..
Loops	locks, spring, box, ammunition, B.L. 12-pr.	..	..	2	Box spring, tensile stay ..	..	..
	draught limber, field, { double	..	..	1	Bolts, tensile stay ..	..	..
Loops	B.L. 12 pr. { single..	..	..	4	..	..	..
	handspike ..	..	..	3	..	..	..
Leathers	spring lock { 1 1/2-in. { x 1 1/2 in. . .	..	..	2	..	..	..
	block, brake, B.L. 12 pr.†	..	..	2	..	..	..
Loops	hand ..	..	..	2	..	..	..
	levers, hand, releasing brake, B.L. 12-pr.†	..	..	2	..	..	..
Loops	locks, spring, box, ammunition, B.L. 12-pr.	..	..	2	..	..	..
	draught limber, field, { double	..	..	1	..	..	..
Loops	B.L. 12 pr. { single..	..	..	4	..	..	..
	handspike ..	..	..	3	..	..	..
Leathers	spring lock { 1 1/2-in. { x 1 1/2 in. . .	..	..	2	..	..	..
	block, brake, B.L. 12 pr.†	..	..	2	..	..	..
Loops	hand ..	..	..	2	..	..	..
	levers, hand, releasing brake, B.L. 12-pr.†	..	..	2	..	..	..
Loops	locks, spring, box, ammunition, B.L. 12-pr.	..	..	2	..	..	..
	draught limber, field, { double	..	..	1	..	..	..
Loops	B.L. 12 pr. { single..	..	..	4	..	..	..
	handspike ..	..	..	3	..	..	..

† For Mark I carriage only.

† For Mark II carriage only.

MATERIALS, REPAIRING CARRIAGES, &c.—continued.

	War. — Three Months Supply.	For use in Peace. — Twelve Months Supply.	For what Purpose.	Where carried.
Nuts, hexagon, $\frac{1}{2}$ inch .. ..	10	6	Foot rests, &c. .. ..	No. 3 drawer, wheelers tool chest.
Packings, hydraulic buffer, B.L. 12-pr.†	6	..	.. ..	..
Plus, shaft, No. 1 shaft .. ..	1	..	.. ..	} Forge limber.
Plates, camp kettle, field, B.L. 12-pr. ..	2	..	.. ..	} Store wagon body.
Plugs, filling, hydraulic buffer† .. ..	1	1	.. ..	" "
.. .. $\times 1\frac{1}{2}$ in. ..	20	6	Hooks, limber, tensile stays, and box stops.. ..	" "
.. .. $\times 1\frac{1}{4}$ in. ..	20	..	Plates, clip, axletree, and ammunition wagon stays ..	..
.. .. $\times 1\frac{1}{4}$ in. ..	20	6	Plates, locking transoms, and stays .. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	20	..	Carriage brackets, joint plate, and handspike loop .. ..	No. 3 drawer, wheelers tool chest.
.. .. $\times 1\frac{1}{2}$ in. ..	20	6	Band under box, hook drag shoe and plates lashing ammunition boxes .. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	12	..	Plates, camp kettle .. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	6	4	Hasp and hinges, trail box .. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	30	4	Movable steels .. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	1	1	.. ..	Forge limber.
.. .. $\times 1\frac{1}{2}$ in. ..	5	..	.. ..	..
.. .. $\times 1\frac{1}{2}$ in. ..	2	..	Securing ammunition boxes .. ..	..
Rods, connecting gun, B.L. 12-pr.† ..	..	..	.. ..	..
Screws .. ..	..	..	.. ..	..
.. .. { looped, No. 3, flat ..	..	..	.. ..	..
.. .. { thumb, B.L. 12-pr. ..	..	..	.. ..	..
Rivets .. ..	..	..	.. ..	..
.. .. { iron, boss head ..	..	..	.. ..	..
.. .. { $\frac{1}{2}$ in. $\times 1\frac{1}{4}$ in. ..	..	..	.. ..	..
.. .. { $\frac{1}{2}$ in. $\times \frac{3}{4}$ in. ..	..	..	.. ..	..
.. .. { steel, conical head, $\frac{3}{4}$ in. $\times 3$ in. ..	..	..	.. ..	..



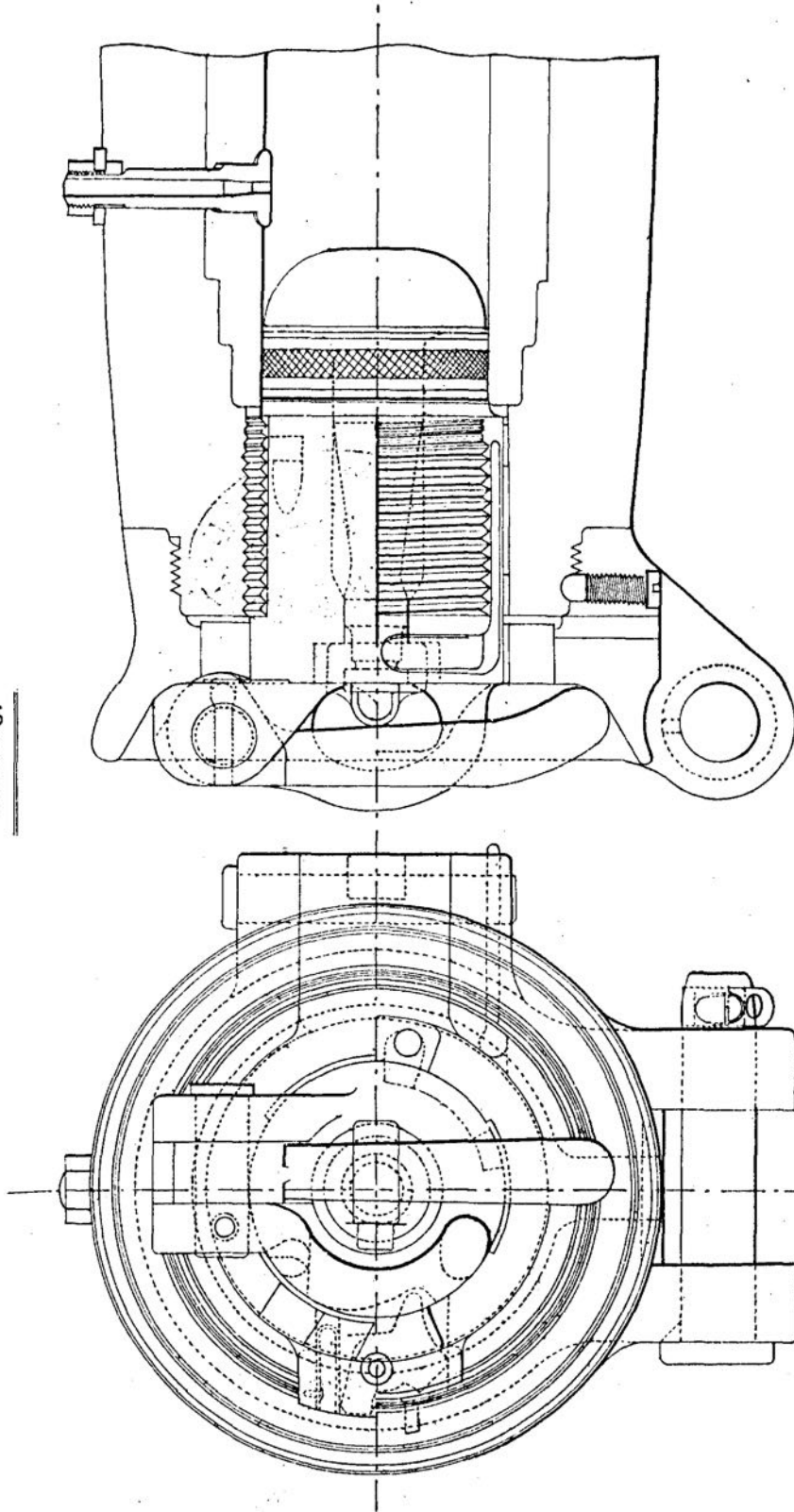
## MATERIALS, REPAIRING CARRIAGES, &amp;c.—continued.

	War. — Three Months Supply.	For use in Peace. — Twelve Months Supply.	For what Purpose.	Where carried.
1 1/4 in. x 30 in.	1	—	Drag shoe ammunition wagon ..	Store limber.
x 44 in., C.B.	12	—	Knapsacks ..	
x 44 in.	3	—	Camp kettle lids ..	
x 36 in.	2	—	Picket post ammunition wagon ..	
x 32 in.	6	—	Blankets with buckling piece ..	
x 30 in.	4	2	Maul head and drag rope ..	
x 26 in.	4	—	Case for oil can, case for tin grease box, and handspike on splinter bar ..	
1 in.	6	—	Swords ..	
x 22 in.	4	—	Pickaxe, carbine, reaping hooks, and shovel or spade ..	
x 18 in.	4	—	Felling axe, water brush, reaping hook, hammer claw, and tube pocket ..	
x 13 in.	4	—	Camp kettle handles, billhook, and props ..	
x 10 in.	4	2	Blanket, with buckling piece for seat ..	
x 22 in.	2	—	Couplings; hand, leather ..	
x 13 in.	15	—	.. ..	
3 in.	4	—	.. ..	
Ties, lynch pin ..				Forge limber.
Turnbuckles, box, under wagon ..				

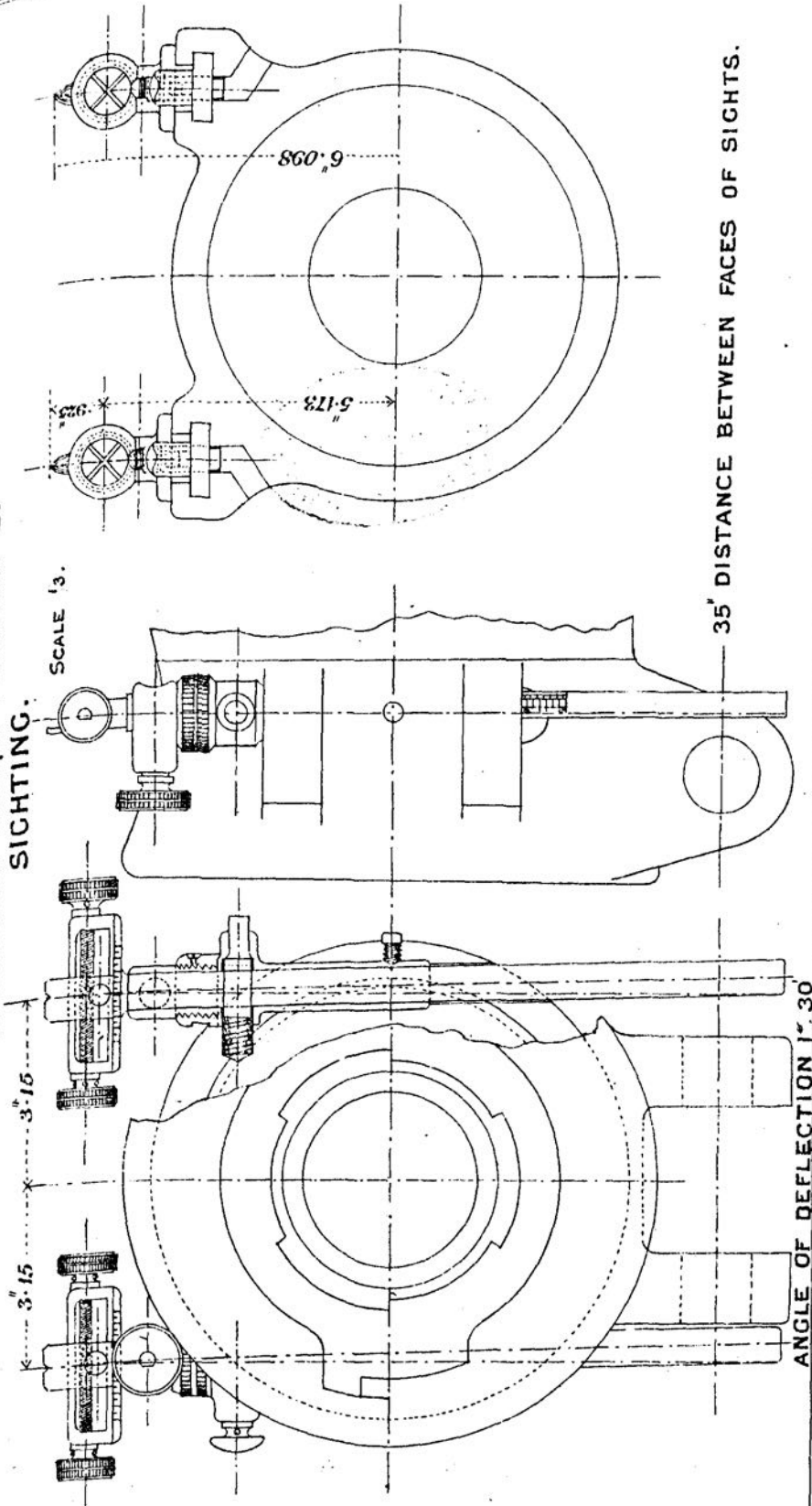
(Wt. 1788 2500 4 | 91—H &amp; S 5973)

ORDNANCE B. L. BREECH CLOSING MECHANISM, 12 P<sup>R</sup>. MARK I.

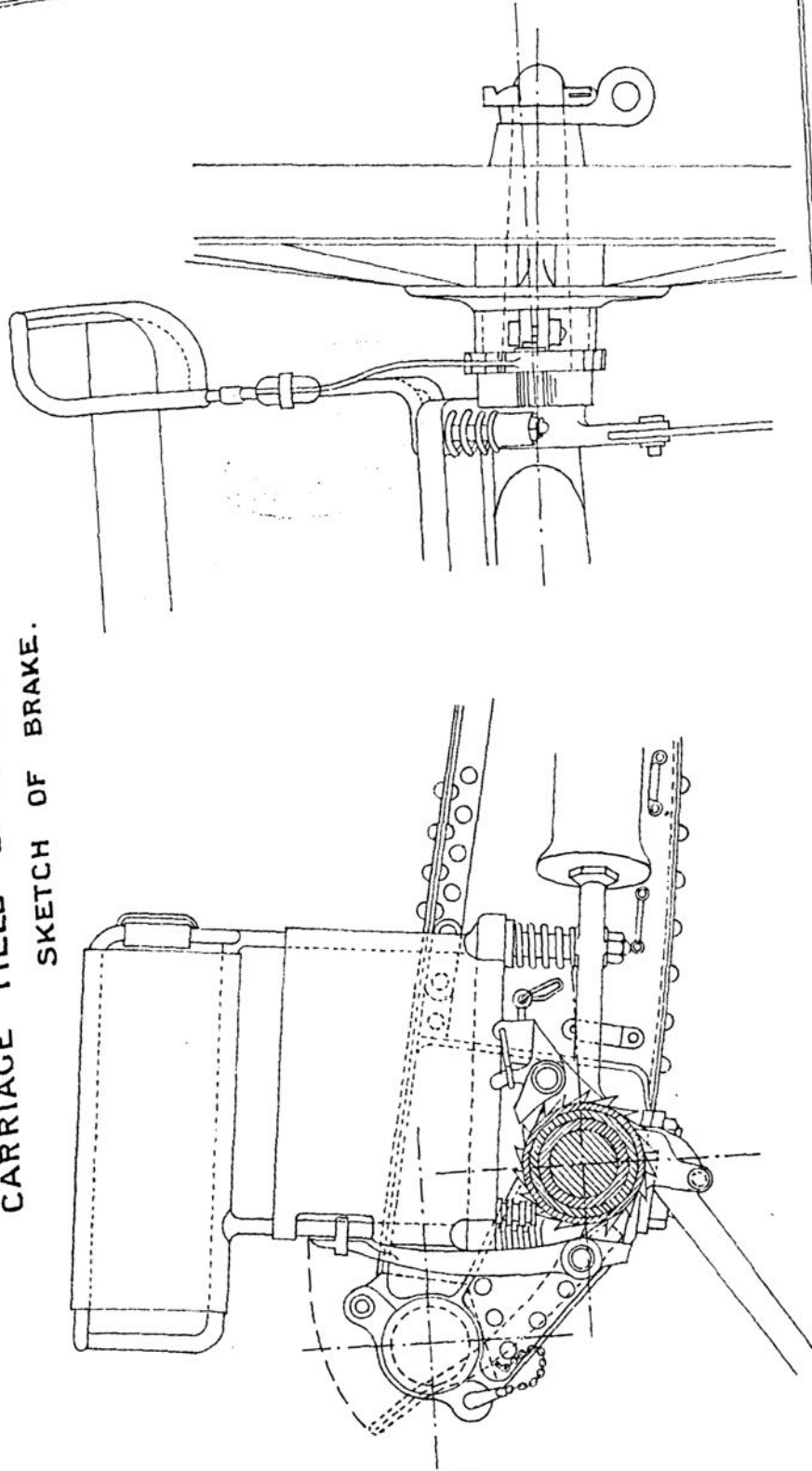
SCALE  $\frac{1}{3}$ .



ORDNANCE B.L.12 PR. MARK I.  
SIGHTING.

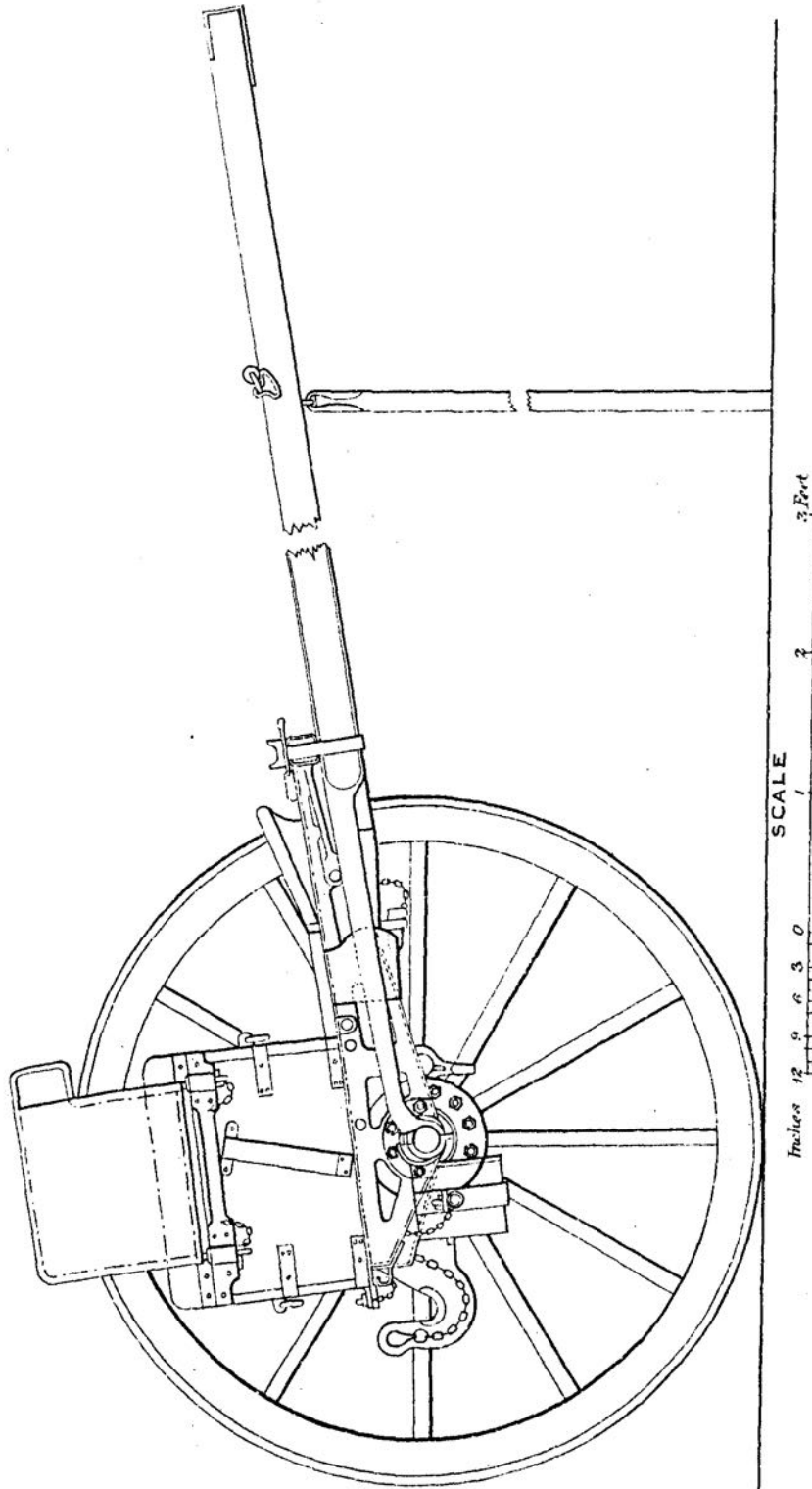


CARRIAGE FIELD B. L. 12 P<sup>R</sup> MARK I.  
SKETCH OF BRAKE.

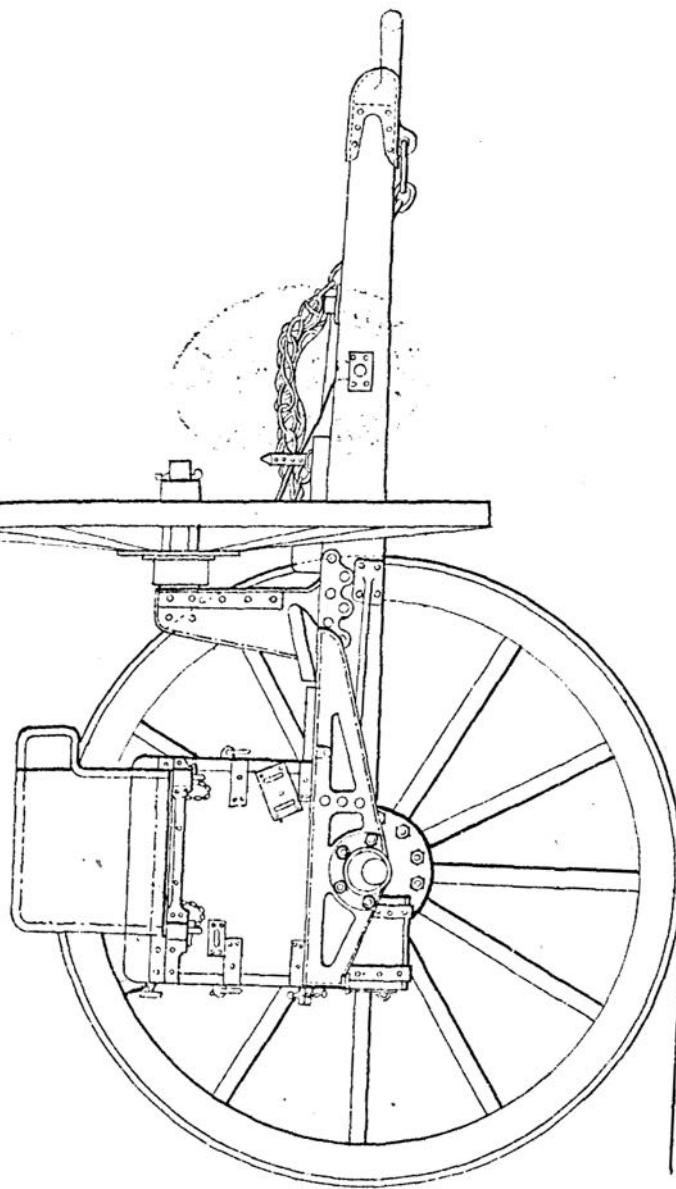




LIMBER FIELD, B. L. 12 P<sup>R</sup>. CARRIAGE, WOOD BOXES. MARK I.



WAGON, AMMUNITION B. L. 12 PR WOOD BOXES. MARK I.

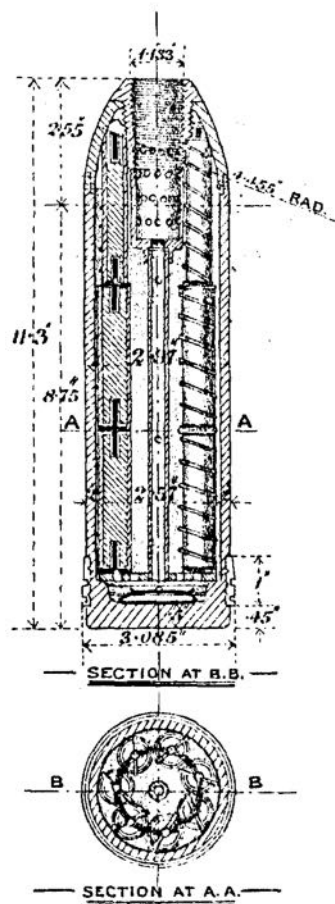


Inches 12 9 6 3 0  
SCALE 1 2 3 Feet

SHELL B. L. STAR 12 PR.

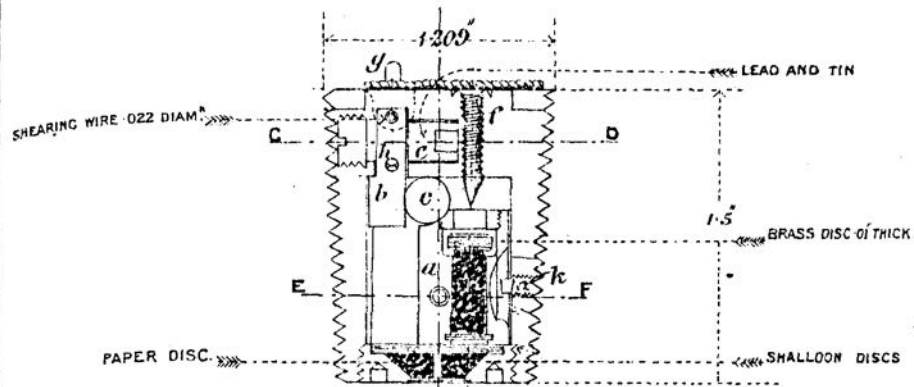
MARKS I & II.

Scale  $\frac{1}{4}$ .

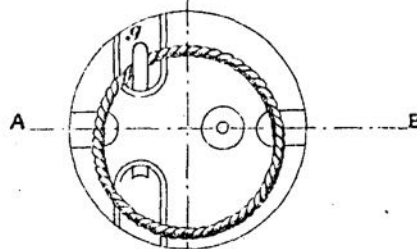


# FUZE, PERCUSSION SMALL MARK I\*

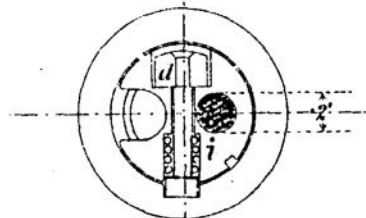
FULL SIZE.



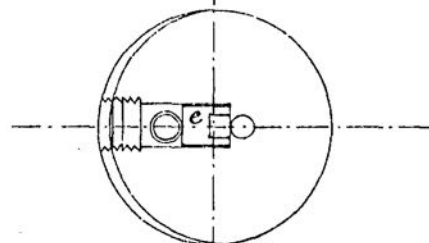
SECTION AT A. B.



PLAN.



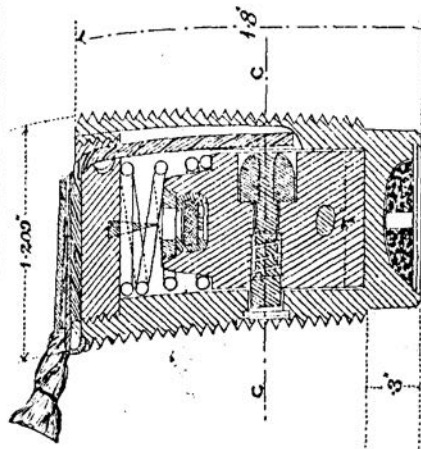
SECTION AT E. F.



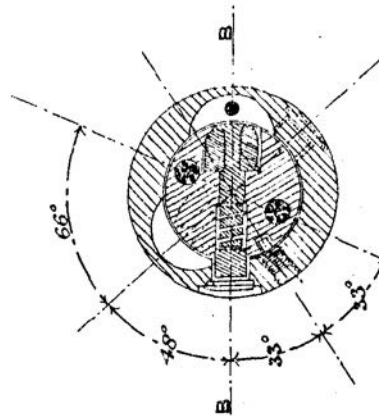
SECTION AT C. D.

# FUZE PERCUSSION SMALL MARK III.

Full Size.



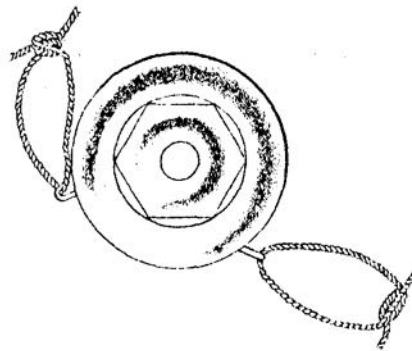
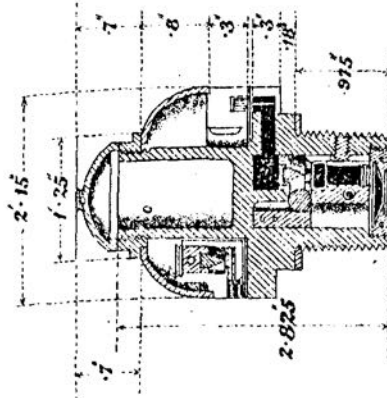
SECTION AT B.B.



SECTION AT C.C.

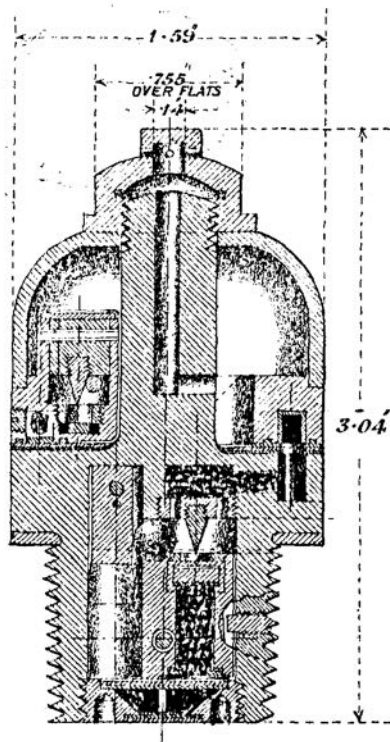
# FUZE TIME AND PERCUSSION MIDDLE MARK I.

Half Size.



# FUZE TIME AND PERCUSSION SHORT MARK II.

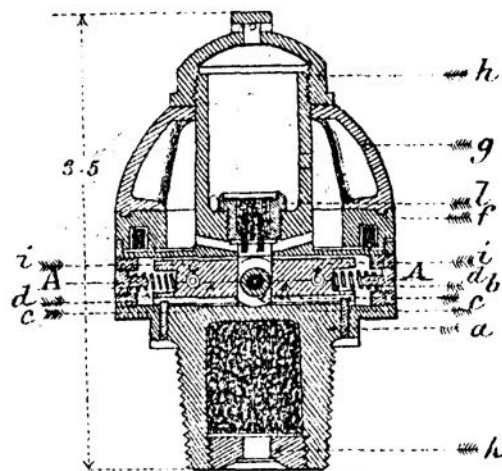
FULL SIZE.



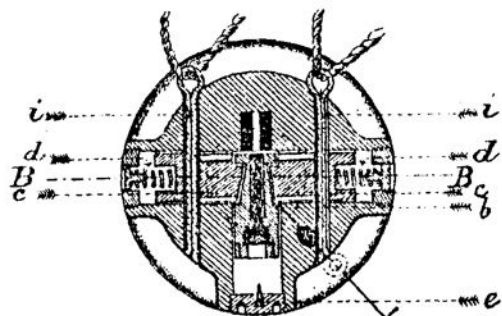
FUZE, TIME, SENSITIVE, MIDDLE.

Nº 24. MARK I.

$\frac{2}{3}$  r.d Full size.



SECTION AT B.B.



SECTION AT A.A.